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EDITORIAL

Sugar Production.

The suggestion was made recently in the local press that Malaya should again develop a sugar industry, both to meet local consumption and as an export crop. Reference was made to the former sugar plantations in Penang and Province Wellesley, and it was suggested that former sugar estates which had changed to rubber should revert to sugar rather than replant with high-yielding rubber.

On the face of it it seems reasonable that Malaya should be at least self-supporting in the case of sugar, but before commercial interests can be encouraged to undertake considerable capital outlay for the expensive modern factories now necessary for efficient sugar manufacture, they will need to be convinced of the possibilities of developing a successful sugar industry in this country.

The former Malayan sugar estates closed down because they could not meet world competition, and that competition is now much more highly developed than at the end of the last century, and factory procedure much more efficient.

It is probable that the relative efficiency of modern sugar factories in the major producing countries is much about the same, but factory production costs are closely related to the quality of cane available, i.e. percentage sucrose of the cane. Field production costs are affected by the yield of cane per acre. It will be clear that overall production costs will be lowest with a high yield of cane in the field and a high sucrose content of the cane.

Available data are scarce regarding the quality of sugar-cane formerly grown commercially in Malaya, but what there are suggest that cane yields were low and sucrose content extremely low, so much so that an industry based on similar planting material could not hope to meet world competition. It is highly probable that high-yielding varieties of cane, suitable for Malayan soils, could be imported, but what is doubtful is the development of high quality juice, i.e. high in sucrose content and purity, owing to Malaya's considered lack of proper ripening conditions for which a consistent and well-marked sunny period of comparatively low temperature and dry atmosphere is necessary.

Intensive experimentation would ultimately provide the answers to the uncertainties mentioned above, but it is doubtful if such experimentation would be justified at the present time in view of the pressing claims of

more urgent problems on the Department of Agriculture. Moreover it must be remembered that, previous to the last war, world sugar production was restricted by international agreement owing to over-production, and there is no guarantee that such a situation will not again arise.

Cocoa. Considerable experimental work is being carried out by the Department of Agriculture in connexion with the possible development of a cocoa industry in Malaya. Part of this work is being devoted to the bulking up of available supplies of planting material, and one branch of investigation has been concerned with ascertaining the most satisfactory methods of vegetative propagation.

As is well known, trees grown from seed, even from isolation nurseries, may vary considerably in growth and yielding capacity, and, to obtain a uniform stand of high-yielding trees, vegetative propagation is essential from selected parent stock.

An article in this issue summarises the results obtained from preliminary trials in the propagation of cocoa by means of cuttings and budgrafting of seedlings. The technique developed is described, and plants have been established by both methods without difficulty, although in budgrafting it was found that the bud patches were somewhat slow to shoot.

Groundnuts. Although Malaya has always been a large importer of groundnuts little interest has been taken in growing the crop, and the total acreage under it is only in the neighbouring of 2,000 acres.

The Department of Agriculture has never ceased to advocate it as an alternative cash crop for the smallholder, and an article in this issue describe experiments which have been carried out since the war to obtain additional information on cultivation and manuring.

Experiments carried out before the war with groundnuts as an off-season crop on padi land were repeated, since the effect on the subsequent padi crop could not previously be ascertained because of the war. After the 1948 off-season cultivation of groundnuts the padi crop gave an increased yield of 24 per cent. over padi plots remaining uncultivated in the off-season, but similar increases have been obtained as a result of growing sweet potato as an off-season crop so that no special conclusions can be drawn from this aspect of the experiment.

The experiments have shown that no advantage is gained in planting groundnuts on beds rather than on the flat except under conditions such as in padi fields where water-logging may be expected.

Oil Palms. For many years oil palm estates have experienced a bronzing of palm leaves, followed usually by yellowing and subsequent wilting leading to a decrease in yield of fruit. The Department of Agriculture has in the past given much time to a study of this problem, and manurial experiments carried out before the war with potash and other manures mostly failed to show any positive response. One of these experiments was laid down using a potassium and magnesium fertilizer.

This treatment gave more promising results, causing a reduction in bronzing and wilting, and also giving increased yields. Since it was not possible to publish a full account of this experiment before the war, an article has been compiled from the records and notes left by the late Mr. A. B. Lucy, who was responsible for carrying out the investigation, and is published in this issue.

While the results obtained in this initial experiment cannot be taken as conclusive since it was carried out only on one area of hill quartzite soil, they give favourable indications of the possibilities of this fertilizer treatment, and more complex experiments have been planned and will shortly be laid down.

Vegetable Cultivation in Malaya.

A considerable vegetable production industry had developed at Cameron Highlands before the war. It increased in size during the enemy occupation owing to an influx of vegetable gardeners to what doubtless seemed a more peaceful and remote district. Since the war the industry has continued to flourish, and, before regular supplies of vegetables recommenced from Australia and China, boom conditions were experienced.

Production in 1941 was estimated at 4,000 tons, and in 1946 it was considered that this output had been doubled, with a value of at least $5,000,000 to producers. Production in 1947 was estimated at 7,800 tons, but the gross value of the crop had decreased to $2,500,000. A still higher rate of production was reached in 1949, the average monthly production being slightly over 1,000 tons.

The principal crop grown on the Highlands is cabbage, and, with a view to encouraging growers to increase the variety of vegetables cultivated, partly to meet the reduced market price of cabbage, the Department of Agriculture has been carrying out a series of experiments with improved varieties of vegetables likely to be successful.

An article summarizing the results of these experiments is published in this issue of the Journal, from which it will be seen that a total of fourteen varieties, new to Cameron Highlands, of eleven different kinds of vegetables proved to be of outstanding quality or yield capacity, and that it is considered that their introduction would benefit the industry.

Another article in this issue deals with a different aspect of the Cameron Highlands vegetable industry. It has long been the practice of the growers to use prawn dust as a fertilizer, and, conveniently, the lorries which have carried their produce down to the plains have brought back supplies of prawn dust. Such a practice has inevitably given almost a complete monopoly of this fertilizer trade to the transport owners and prices of prawn dust have been high.

Prawn dust, in addition to being of very variable quality, is an extremely unpleasant smelling material. It was suspected of being the cause of the large swarms of flies that infested the Highlands, and its use was prohibited in the residential area.

Since a fertilizer was clearly needed to maintain the fertility of the soil under the constant and heavy cropping, experiments were laid down by the Department of Agriculture in conjunction with a local firm of fertilizer manufacturers. The results of these experiments show that, for a very much reduced expenditure and quantity of fertilizer, similar yields were obtained as with the larger and more expensive dressings of prawn dust, the saving in cost amounting to $678 per acre. Such important results should have a considerable bearing on the future development of the Cameron Highlands vegetable industry.

Propagation of Tea from Cuttings.

In the editorial comment in the April, 1949, issue on the above article by Mr. H. J. Simpson the following statement was made: ".....the lack of tap root..... will at a later date seriously weaken the resistance of the tea bush to the result of severe pruning since it is suggested that the tap root contains reserves of starch which are essential to carry the bush over this period."

Mr. Simpson considers that this sentence is misleading and needs clarification. The question of starch reserves in the tap roots of tea has been under investigation by the Tea Research Institute of Ceylon for a number of years and it has been found that at low elevations starch does not accumulate at any stage of the tea bush's life. On the other hand at high elevations starch reserves do accumulate, and the higher the elevation the greater this accumulation. The lack of starch reserves in the roots of lowland tea in Malaya was also noted in tests made on bushes at the Federal Experimental Station, Serdang, by the Senior Chemist of the Department of Agriculture before the war.

Since lowland tea has no reserves it is essential that the pruning of such bushes be carried out in such a manner as to allow of sufficient photosynthesis to enable the bushes to recover from the shock of pruning. This necessity has resulted in such pruning methods as lung or fringe pruning, wherein a certain number of the smaller leaf branches are left untouched. Normal pruning consisting of hard cutting back is possible at higher elevations because the plants have some starch reserves; it is, however, not to be recommended, and less drastic methods will undoubtedly benefit the plants. Provided that no reliance is placed upon starch reserves that may or may not be there, the argument that the lack of a tap root in bushes raised from cuttings will seriously weaken the resistance of the bushes to pruning is not valid and need not be considered.

VEGETABLE VARIETY TRIALS AT CAMERON HIGHLANDS IN 1948

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Introduction.

An important minor industry of vegetable production has been developed at Cameron Highlands, at an elevation varying between 3,000 and 5,000 ft. above sea level. Starting in 1930, when access to the district was first made possible, output reached a total of 4,000 tons in 1941, in spite of competition with imported vegetables from the Netherlands Indies, Hong Kong and Australia. During the occupation of Malaya by the Japanese, clearing of new land continued and an influx of gardeners took place, crops grown being almost exclusively confined to cabbages. After the war the boom continued but owing to increased and comparatively regular shipments from Australia and China, the price of cabbages fell considerably. This led to an increase in the number of varieties grown but crops still remained limited to cabbage, Chinese cabbage (*Pe-tsai*), Chinese radish (*lobak*), carrots, leeks and tomatoes. It then clearly became necessary to widen the range of vegetables grown, and arrangements were made to import improved varieties of the crops most likely to be successful; these were tested amongst themselves or against local varieties where such existed. The trials described below are concerned with the varieties and strains ordered in 1947 and tested in 1948; they were conducted at the Agricultural Station, Tanah Rata, Cameron Highlands, Pahang.

Origin of Seed.

Seed was ordered from several sources and those from which it was available for trials in 1948 are shown below: the abbreviation shown, following each, indicates the source in the tables given later in this article.

Australia	..	A
Burpee's, U.S.A.	..	B
China	..	C
Goviers, Canada	..	G
India	..	I
Java	..	J
Local	..	L
Yates', Australia	..	Y
Zwaan's, Holland	..	Z

Experimental Methods.

The lay-outs used in the trials were either Latin Squares or randomised blocks. The vegetables were generally grown on beds, 4 ft. wide,

with 2 ft. drains between them. In assessing the statistical significance of the differences between yields, only probabilities of less than 5 per cent. (1 in 20) were considerd to be proof of significance. Significance was tested either by Fisher's "Z" table or Snedecor's "F" table, the magnitudes of significant differences being calculated from Students' "t" table.

The Experiments.

ROOTCROPS.

Beet. (Expts. C.H. 4/48 and C.H. 20/48).

There is always a ready sale for beetroot of good quality and the commonest varieties grown are Yates' Derwent Globe and Flat Egyptian. These varieties were therefore used as controls in the first trial. The varieties tested, their origin and yields are shown in Table I.

Table I.

The Results of Two Beet Trials.

Variety.	Origin.	Total Yield in lbs.	Yield as Percentage of Mean.	Yield in lbs. per acre.
(Expt. C.H. 4/48)				
Extra Early ..	B	205	63	3,383
Derwent Globe	Y	180	55	2,970
Lutz Green Leaf ..	B	702	214	11,583
Flat Egyptian ..	Y	270	82	4,455
Red Ball ..	B	282	86	4,653
Mean ..		327.8	100	5,409
(Expt. C H. 20/48)				
Detroit Dark Red ..	Z	1,285	114	9,329
Detroit Dark Red ..	Z	940	84	6,824
Crosby Egyptian ..	Z	1,260	112	9,148
Lutz Green Leaf ..	B	1,007	90	7,311
Mean ..		1,123	100	8,153

Lutz Green Leaf proved to be an outstanding introduction as it yielded heavily and was far superior in quality to the other four varieties in the first trial. The leaves of this beet were glossy-green with a pink midrib and growth was vigorous. The roots were top-shaped, about 4 ins. in diameter and the flesh was dark red, tender and sweet. All dealers were most impressed by its quality and there was at once a keen and insatiable demand for seed.

The crop in the second trial was very uneven owing to severe cutworm attack, and yield differences were all statistically insignificant. Lutz Green Leaf was again judged to be the best for quality, with the Dutch strain of Detroit Dark Red second. This latter variety would be worth a second trial.

Crosby Egyptian gave a small root and was looked on with disfavour by dealers.

Carrots. (Experiments C.H. 5/48 and C.H. 21/48).

Carrots are one of the five most important crops at Cameron Highlands, and Yates' Manchester Table is the variety grown almost exclusively; this was therefore grown as control in both trials. The varieties tested, their origin and yields are shown in Table II.

Table II.

The Results of Two Carrot Trials.

Variety.	Origin.	Total Yield in lbs.	Yield as Percentage of Mean.	Yield in lbs. per acre.
(Expt. C.H. 5/48)				
Local No. 4 ..	Y	114	97	1,689
Amsterdam Forcing ..	B	106	91	1,570
Golden Heart ..	B	124	106	1,837
Local No. 2 ..	Y	116	99	1,719
Manchester Table ..	Y	169	144	2,504
Half Long Nantes ..	B	99	85	1,467
Danvers Half Long ..	Y	89	76	1,319
Mean ..		116.7	100	1,729
(Expt. C.H. 21/48)				
Chantenay Red Core ..	C	1,112	80	10,091
L. R. Stumprooted Coreless ..	D	1,255	90	11,389
Manchester Table ..	Y	1,439	103	13,059
Nantes Half Long ..	C	1,591	114	14,438
Danvers Half Long ..	C	1,582	113	14,357
Mean ..		1,396	100	12,667

No difference in yield in either experiment attained statistical significance and nothing can be concluded from observed differences. In both trials the crop was uneven because of cutworm attack.

Dealers considered that Manchester Table, the local standard variety, possessed the best quality but Amsterdam Forcing, Half-Long Nantes and Danvers Half-Long were all of good quality.

Growers preferred Manchester Table to all other varieties and it will always be grown whenever seed is available. This variety is remarkable in its sparse growth of foliage and it appears to be well suited to local conditions.

Radishes. (Experiment C.H. 9/48).

This is not an important crop but there is a small and constant demand which is easily filled. However, quality of retailed radishes is often poor. The varieties tested, their origin and yields are shown in Table III.

Table III.
The Results of a Radish Trial.

Variety.	Origin.	Total Yield in lbs.	Yield as Percentage of Mean.	per acre. Yield in lbs.
(Expt. C.H. 9/48) Earliest Scarlet Button ..	B	525	100	5,082
Rapid Red ..	B	456	87	4,414
Long Scarlet ..	Y	512	97	4,956
French Breakfast ..	Y	610	116	5,905
Mean ..		525.75	100	5,089

Yield differences just failed to attain significance at 5 per cent. The American varieties were earlier-maturing than the Australian ones and harvest was left somewhat too late. The first two were round and the others long-rooted. Earliest Scarlet Button was considered the best for quality by one dealer.

Parsnips. (Experiment C.H. 12/48).

This trial was a failure because all varieties gave negligible germination in the field although a germination test had previously given a moderate result. Germination is known to fall off very rapidly indeed and it is recognised by growers that three or four sowings may have to be carried out in order to establish a crop. Furthermore wet weather, when the crop is coming through, will often wipe out 90 per cent. of the seedlings.

Turnips. (Experiment C.H. 33/48).

There is a small local demand for turnips but the crop is not an important one. However, seed of two Canadian varieties was received for testing and was compared with Yates' Champion Purple Top. The varieties tested, their origin and yields are shown in Table IV.

Table IV.
The Results of a Turnip Trial.

Variety.	Origin.	Total Yield in lbs.	Yield as Percentage of Mean.	Yield in lbs. per acre.
(Expt. C. H. 33/48) Early White Flat Dutch ..	C	635	92	8,537
Champion Purple Top ..	Y	1,240	179	16,671
Golden Ball ..	C	200	29	2,689
Mean ..		691.7	100	9,300

The local Champion Purple Top was far superior to the two Canadian varieties both in yield and quality. Golden Ball was very light and dish-shaped and unsaleable locally. Early White Flat Dutch was a better turnip but yields were poor.

Germination and growth were good but the crop had to be protected from leaf-eating beetles by dusting with Gammexane.

LEGUMES.

Lima Beans. (Experiment C.H. 1/48).

It was intended to test Fordhook 242 (B) against the best local variety of Australian origin. When it was found that the latter was a French Bean it was discarded and half of the Fordhook plots were harvested as marketable young pods and half as ripe seed. Yields of both were disappointing and the quality of seed was very poor; yields were as follows:

Yield of young pods .. 2,896 lbs. per acre.
Yield of mature seed .. 942 lbs. per acre.
Yield of dried seed .. 707 lbs. per acre.

It was considered that this was a luxury crop which would only thrive in dry weather. The quality of dried seed showed that it would be impracticable to save seed at Cameron Highlands except during very dry periods.

French Beans. (Expts. C.H. 3/48, 19/48 & 39/48).

French Beans are an important local crop, the normal variety grown being Canadian Wonder of Australian origin. However, seed of this variety may be grown locally for several generations without marked deterioration. The varieties tested, their origin and yields are shown in Table V.

Table V.

The Results of Three French Bean Trials.

Variety.	Origin.	Total Yield in lbs.	Yield as Percentage of Mean.	Yield in lbs. per acre.
(Expt. C.H. 3/48)				
Tender Green ..	B	224	144	2,259
Bountiful ..	B	131	84	1,321
Canadian Wonder ..	L	113	72	1,139
Mean ..		156	100	1,573
(Expt. C.H. 19/48)				
Dwarf Stringless Green Pod ..	Z	967	173	8,776
Bountiful ..	B	277	50	2,514
Canadian Wonder ..	L	315	56	2,859
Tender Green ..	B	906	162	8,222
St. Fiacre ..	B	324	58	2,940
Mean ..		557.8	100	5,062
(Expt. C.H. 39/48)				
Boentjis ..	J	240	240	4,356
Polong Gadjah ..	J	144	144	2,613
Beunteur Leuleus ..	J	0	0	0
Canadian Wonder ..	L	76	76	1,379
Katjang Soerat ..	J	40	40	726
Mean ..		100	100	1,815

In the first trial Burpee's Tender Green proved to be superior both in yield and quality to the other two varieties. Pods were about 6 ins. long, dark green, smooth, tender, straight and stringless. The flavour was excellent and all dealers preferred it to the normal Canadian Wonder. As this proved to be such a good introduction, it was decided to test it again in another trial.

In the second trial results were affected by the age of the Tender Green seed. This variety gave only 30 per cent. germination, which was allowed for when planting, and the plants were less vigorous than in the first trial. Nevertheless the Dutch Dwarf Stringless Green Pod and Tender Green proved to be superior in yield and quality to the other three varieties.

The Canadian Wonder plants were the most vigorous but both this variety and St. Fiacre proved to be susceptible to *Agromyza* attack.

There was little to choose between the quality of the two heaviest yields. However, the Dutch variety has the notable economic advantage that it can be purchased for guilders, whereas Tender Green requires American dollars. Furthermore there is a Singapore agency for the Dutch seed.

The Javanese seed tested in the third trial was received without any additional information about the varieties. As fresh Tender Green seed was not available, Canadian Wonder was used as control variety.

Boentjis proved to be superior to all the others in yield, and comparable in quality to the locally grown Canadian Wonder. However, it proved to be a climbing or pole-bean, whereas the bush-type is favoured by growers.

Polong Gadjah proved to be a Green Pea and inferior to local green peas. Katjang Soerat gave a low yield and the beans were fibrous and of poor quality.

Beunteur Leuleus plants were all destroyed by *Agromyza* attack and failed to yield a crop.

It may be concluded that Boentjis would be worth a second trial against Tender Green but, until then, it would not be worth introducing.

Sugar Peas. (Expts. C.H. 10/48 and 30/48).

This is a luxury crop for which there is a small steady demand. Prices offered are usually high. The varieties tested, their origin and yields are shown in Table VI.

In the first trial Maule's Giant Sugar Pod was superior in yield to Giant Butter and Greenfeast and the differences were significant at 1 per cent. Yorkshire Hero yielded statistically more (at 5 per cent.) than Greenfeast. Vegetative growth was excellent in the two best yielders and the vines reached 10 ft. in height. Greenfeast plants were yellow and stunted and the variety is obviously unsuited to local conditions.

Both the Burpee's varieties were of excellent quality with long, sweet and tender fleshy pods. Giant Butter Pods were a darker green than the Giant Sugar Pods but the latter were larger, somewhat sweeter and of a better shape.

Table VI.
The Results of Two Sugar Pea Trials.

Variety.	Origin.	Total Yield in lbs.	Yield as Percentage of Mean.	Yield in lbs. per acre.
(Expt. C.H. 10/48)				
Giant Butter ..	B	139	64	2,018
Maule's Giant Sugar Pod ..	B	392	181	5,692
Yorkshire Hero ..	Y	250	116	3,630
Greenfeast ..	Y	84	38	1,220
Mean ..		216.25	100	3,140
(Expt. C.H. 30/48)				
Giant Butter ..	B	71	67	1,288
Dwarf Gray Sugar ..	C	33	31	599
Local ..	L	164	155	2,976
Forty Days ..	Z	131	124	2,377
Maule's Giant Sugar Pod ..	B	129	122	2,341
Mean ..		105.6	100	1,916

In the second trial the Dutch "Forty Days" variety proved to be a Green Pea although it was said by the retailers to be a Sugar Pea.

The best yielders were the local sugar pea and Maule's Giant Sugar Pod. Both were of good quality.

Growth of Giant Butter and Dwarf Gray Sugar was very poor, perhaps because of wet weather at the time of most active growth. The latter variety produced very small pods which were disliked by dealers.

The local variety, which was not available for the earlier trial, is so good that it is doubtful if the Maule's Giant Sugar Pod would be worth importing in quantity since seed must be purchased for American dollars. However, it would be well worth a further trial.

Green Peas. (Expts. C.H. 11/48 and 29/48).

There is always a small but brisk demand for good quality Green Peas. Prices are high but yields low. The varieties tested, their origin and yields are shown in Table VII.

Both trials showed conclusively that the local Earlicrop was superior to all other varieties in yielding capacity. Since the quality of this variety was also good and growth vigorous, it is obvious that no other variety would be worth importing.

The imported varieties were mostly dwarf in habit but Fordhook Wonder grew taller in the second trial than in the first. Dealers considered this variety to be a sugar pea and it might be worth a re-trial as such.

The quality of all imported varieties was excellent as they produced a larger pea than Earlicrop and they were somewhat sweeter. Both American Wonder and Thomas Laxton would be suitable parents for crossing with Earlicrop, with a view to producing seedlings with the vigour and yield capa-

city of the latter and the flavour and large pea-size of the former.

Table VII.

The Results of Two Green Pea Trials.

Variety.	Origin.	Total Yield in lbs.	Yield as Percentage of Mean.	Yield in lbs. per acre.
(Expt. C.H. 11/48)				
American Wonder ..	B	182	44	1,452
Fordhook Wonder ..	B	69	17	550
Earlicrop ..	L	996	240	7,946
Mean ..		415.7	100	3,316
(Expt. C.H. 29/48)				
Fordhook Wonder ..	B	20	38	3,630
Earlicrop ..	L	180	340	32,670
American Wonder ..	B	20	38	3,630
Thomas Laxton ..	Z	29	55	5,264
Little Marvel ..	C	16	30	2,904
Mean ..		53	100	9,620

Gourds.

Cucumber. (Expts. C.H. 2/48 and 36/48).

The varieties tested in the first experiment, their origin and yields are shown in Table VIII. The second experiment was a failure on account of wet weather.

Table VIII.

The Results of a Cucumber Trial.

Variety.	Origin.	Total Yield in lbs.	Yield as Percentage of Mean.	Yield in lbs. per acre.
(Expt. C.H. 2/48)				
Local Chinese ..	L	1,167	65	6,419
Burpee's Hybrid ..	B	2,405	135	13,228
Mean ..		1,786	100	9,823

Burpee's Hybrid cucumber proved to be a magnificent introduction, being extremely vigorous and even-growing and a very heavy yielder. Fruits were well formed, green and about 8 ins. long. The flesh was seedless, crisp, white and juicy. Growth was so vigorous that a side-shoot appeared at every node and these had to be pruned off. The hybrid nature of the seed was shown by the quite remarkable uniformity of growth and all dealers and growers were most impressed.

Squash. (Expt. C.H. 37/48).

There is a small demand for good quality squash and marrows for local consumption. The varieties tested, their origin and yields are shown in Table IX.

Table IX.

The Results of a Squash Trial.

Variety.	Origin.	Total Yield in lbs.	Yield as Percentage of Mean.	Yield in lbs. per acre.
(Expt. C.H. 37/48)				
Early White Bush ..	Y	1,177	62	10,173
English Vegetable Marrow White Bush	C	2,450	130	21,175
Zucchini Grey ..	C	2,010	107	17,372
Mean ..		1,879	100	16,240

The English Vegetable Marrow White Bush yielded best and was of excellent quality. There would be a small demand for seed if it were available locally. Zucchini Grey was similar to the "Labu Ayer" grown on the plains and there would be no point in growing such a variety at Cameron Highlands.

LEAF VEGETABLES.

Lettuce. (Expts. C.H. 13/48 and 31/48)

Lettuce is an important crop for which there is always a good demand. It yields well locally but requires efficient packing and rapid transport.

The two most-favoured local varieties which are grown commercially, to the exclusion of all others, are the black-seeded Imperial 847 and the white-seeded New York Neapolitan. The former is more hardy and usually yields better whereas the latter is of better quality and is normally grown during showery or dry weather. Imperial 847 stands up better to heavy rain. The varieties tested, their origin and yields are shown in Table X.

Table X.

The Results of Two Lettuce Trials.

Variety.	Origin.	Total Yield in lbs.	Yield as Percentage of Mean.	Yield in lbs. per acre.
(Expt. C. H. 13/48)				
Crisp as Ice ..	B	558	73	7,254
Iseberg ..	B	519	68	6,747
New York, P.W.55 ..	B	371	48	4,823
Big White Boston ..	B	734	95	9,542
Big Boston ..	B	1,016	132	13,208
N.Y. Neapolitan ..	Y	952	124	12,376
Imperial 847 ..	Y	1,211	157	15,743
Mean ..		766	100	9,956
(Expt. C.H. 31/48)				
Big Boston ..	B	589	87	12,218
Imperial 847 ..	Y	1,115	164	23,128
Hubbard Market ..	C	507	75	10,517
Big White Boston ..	B	687	101	14,250
Unrivalled ..	C	494	73	10,247
Mean ..		678	100	14,072

Imperial 847, known to be a heavy yielder, cropped best in both trials. However, it has a maturation period of 84 days, as have Big Boston and New York Neapolitan.

Crisp as Ice and Big White Boston matured at 75 days, with other varieties intermediate.

In both trials Big White Boston was considered by all authorities and dealers to be best for size, shape, appearance and eating quality. Considering its maturation period the yield is good and it would be a most desirable introduction both for commercial and amateur growers. If seed were readily available it would certainly replace New York Neapolitan.

Unrivalled and Hubbard Market are good-quality varieties but are not better than Big White Boston to which they are inferior in yielding capacity.

Dealers did not like the Big Boston, particularly the Canadian strain, as it was a poor "hearter" with coarse tasteless leaves.

Chinese Cabbage (Pe-tsai). (Expt. C.H. 14/48).

This is an important crop and there is always a big demand for the vegetable from the Chinese community. This demand exceeds the local supply which is supplemented by imports from Siam. The imported vegetable usually realizes a higher price than the locally-grown one as it has a better heart. It is, therefore, of some importance that the quality of the locally-grown crop should be improved by the introduction of better strains. The varieties tested, their origin and yields are shown in Table XI.

Table XI.

Results of a Chinese Cabbage (Pe-tsai) Trial.

Variety.	Origin.	Total Yield in lbs.	Yield as Percentage of Mean.	Yield in lbs. per acre.
(Expt. C.H. 14/48)				
Burpee's Pe-tsai ..	B	7,772	97	23,510
Local Pe-tsai ..	C	8,258	103	24,980
Mean ..		8,015	100	24,245

Growth of both varieties was excellent, in spite of initial cut-worm damage, and there was no difference in yielding capacity. The local variety was tall, open and green with broad leaves whereas the Burpee's variety, which was equally tall, had the inner leaves folded tightly around the thick, well-blanched heart. The latter was tender and juicy and had a good flavour when eaten either raw or cooked.

All dealers agreed that the Burpee's vegetable was superior in quality to the local strain and it would certainly command a higher price. This may therefore be considered an excellent introduction. It should, however, be tested against selected varieties from other non-dollar countries.

Cabbage. (Expts. C.H. 15/48 and 22/48).

This is the most important vegetable grown at Cameron Highlands. Three varieties are normally grown and, as they grow readily from suckers,

they are all clonal and hence of very even growth and maturation. Yates' Utility is probably the best of these and was used as control in the second trial. The varieties tested, their origin and yields are shown in Table XII.

Table XII.

The Results of Two Cabbage Trials.

Variety.	Origin.	Total Yield in lbs.	Yield as Percentage of Mean.	Yield in lbs. per acre.
(Expt. C.H. 15/48)				
Early Jersey Wakefield	B	1,614	69	23,435
All Seasons	B	2,569	110	37,302
Wisconsin All Seasons	B	2,355	101	34,049
Surehead	C	2,786	120	40,453
Mean ..		2,331	100	33,810
(Expt. C.H. 22/48)				
Chihili	C	3,306	82	28,573
Utility ..	Y	4,702	116	40,639
All Head Early ..	C	3,669	91	31,711
Golden Acre ..	Z	2,545	63	21,996
Mammoth Red Rock ..	C	3,687	91	31,866
Surehead	C	6,212	154	53,689
Glory of Enkhuizen ..	C	4,157	103	35,928
Mean ..		4,039.7	100	34,915

In the first trial it was originally intended that a total of nine Burpee's varieties should be tested. However, five of these failed to yield a sufficient number of seedlings so they were grown only in observation plots and the trial was re-designed.

In the first trial Early Jersey Wakefield matured in 105 days and growth was very even. Although it yielded less than the other four cabbages it was the only promising introduction as it was of the pointed-heart, "spring-cabbage" type in good demand by the cold storage trade. Flavour was excellent and it would certainly be the best variety for home-garden cultivation.

Burpee's Surehead, the best yielder, gave a very variable crop which matured in 105 to 131 days. The best plants were good drumheads and these were retained for clonal selection. Seed is too variable to be worth introduction.

The two strains of All Seasons were also somewhat variable but the heads were well-rounded, flat-topped and very firm. The maturation periods averaged about 130 days. Dealers liked these as they were well suited to the Chinese market and kept well.

Of these four cabbages only Early Jersey Wakefield would be worth cropping from seed. Certain strains of the other varieties would be valuable if they could be raised easily from axillary cuttings.

The maturation periods of varieties tested in the second trial are given below:—

Chinese Chihili (or *Pe-tsai*)	..	74 days from sowing.
All Head Early Golden Acre Glory of Enkhuizen	..	101 ,, ,, ,,
Yates Utility	..	118 ,, ,, ,,
Surehead Mammoth Red Rock	..	126 ,, ,, ,,

Only the late Canadian Surehead out-yielded Yates' Utility. It gave a large solid head with few outer leaves. The other late variety, Mammoth Red Rock, was also of good quality but yielded less than the somewhat earlier Utility.

The early Glory of Enkhuizen was the outstanding variety, very similar in appearance and quality to Early Jersey Wakefield. It would be well worth introducing for cultivation from seed.

Both All Head Early and Golden Acre were inferior in quality to Glory of Enkhuizen and Golden Acre was also inferior in yielding capacity.

Clonal selections from all these varieties were propagated vegetatively by cuttings, together with selections of the following five Burpee's varieties:

Steins Early Dwarf Flat Dutch
Succession
Allhead Early
Marion Market
Copenhagen Market.

Copenhagen Market was poor and very weak and was discarded at once. The Steins variety was a good early cabbage but variable in shape. Succession was very late with good rounded heads; it resembled a type already cultivated from cuttings at Cameron Highlands.

Marion Market showed some promise as it gave a uniform small cabbage. Burpee's Allhead Early could not be judged because only two plants survived.

All these clonal selections rooted weakly and many died out in wet weather. A few survived to the second generation but these too were eventually lost. It would seem, therefore, that in Yates' Utility we have a cabbage well suited to local conditions as it possesses the all-important character of being easily propagated from cuttings. This clonal propagation gives a most uniform crop and it is doubtful if any medium or late variety would be worth introducing unless the same character can be isolated by selection.

Certain early varieties, notably Glory of Enkhuizen and Early Jersey Wakefield, would be well worth commercial cultivation for seed as there is a small luxury demand for them.

Cauliflower. (Expts. C.H. 18/48 and 32/48).

There is an excellent market for cauliflower but practically none is grown in Malaya. The Indian varieties Early Patna and Early Market do very well on the plains in dry weather but they are not grown commercially. Local growers at Cameron Highlands have experimented with a number of Australian varieties but they are all extremely susceptible to bacterial stem-rot, perhaps because so much of the land has been cultivated with cabbages. Any variety which would yield even moderately would certainly become popular with growers because of the very high prices offered. The varieties tested, their origin and yields are shown in Table XIII.

Table XIII.

The Results of Two Cauliflower Trials.

Variety.	Origin.	Total Yield in lbs.	Yield as Percentage of Mean.	Yield in lbs. per acre.
(Expt. C.H. 18/48)				
Early Patna ..	I	31	9	563
Snowball ..	I	429	126	7,786
Burpeeana ..	B	689	203	12,505
Phenomenal Early ..	A	212	62	3,848
Mean ..		340	100	6,175
(Expt. C.H. 32/48)				
Snowball ..	C	238	118	4,800
Late Patna ..	I	163	81	3,287
Snowball ..	I	208	103	4,195
Maincrop Patna ..	I	74	37	1,492
Zwaan's White Wonder ..	Z	336	167	6,776
Early Patna ..	I	176	88	3,549
Z. Super Snowball ..	Z	214	106	4,316
Mean ..		201.3	100	4,060

Burpeeana was the only outstanding variety and it was superior in both yield and quality to all the others. Dealers and growers were all impressed by the large, uniform, well-rounded, compact heads of pure white flowers.

Phenomenal Early plants were vigorous at first but later became badly attacked by bacterial stem-rot. Sutton's Snowball heads were small and uneven, fairly compact but of a poor colour. Sutton's Early Patna was obviously quite unsuited to local conditions as flowering commenced within a month of transplanting and the tiny heads were quite unmarketable.

Unfortunately seed of Burpeeana was not available for the second trial. Of the seven varieties tested only one, Zwaan's White Wonder, was of any value. Heads of this variety were of good quality, colour and shape but they were too small, 60 weighing only 33.6 lbs. This variety would be worth a second trial using Burpeeana as control.

Spinach. (Expt. C.H. 23/48).

There is a small demand for good spinach but very little is exported to the lowlands, partly because the crop travels badly and partly because so many excellent spinach plants thrive on the plains. Nevertheless, the Department of Agriculture was asked to test six Zwaan's varieties by the Singapore agents. Apart from the New Zealand specimen all were varieties of *Spinacia oleracea* and no local variety was available as control. The varieties tested, their origin and yields are shown in Table XIV.

Table XIV.

The Results of a Spinach Trial.

Variety.	Origin.	Total Yield in lbs.	Yield as Percentage of Mean.	Yield in lbs. per acre.
(Expt. C.H. 23/48)				
Canner King ..	Z	327	67	3,956
New Zealand ..	Z	514	106	6,199
Advance ..	Z	489	101	5,916
Nobel Giant Leaved ..	Z	784	162	9,486
Hollandia Improved ..	Z	394	81	4,767
Tempo Green ..	Z	403	83	4,876
Mean ..		485	100	5,867

Yields were very variable due to uneven germination and cut-worm damage. Experimental error was very high and no yield differences were significant.

New Zealand spinach proved to be unsaleable; there was no local demand and it was said not to travel well. The other varieties were all yellow-leaved, coarse and fibrous. The Australian variety, which is occasionally grown, is dark green with large succulent leaves.

These varieties are quite unsuited to local conditions and there would be no sale for their seed.

Celery. (Expts. C.H. 16/48 and 34/48).

There has always been a small demand for the green Chinese celeries but the white blanching type is very little grown commercially in spite of a good luxury market which is fed by Australian imports. It was for this reason that an attempt was made to find a self-blanching type suited to local conditions. The varieties tested, their origin and yields are shown in Table XV.

In the first trial Burpee's Golden Self-Blanching yielded better than the Local Chinese and this was the only significant difference. The former variety was also the best in quality as it yielded thick, crisp, stringless petioles of excellent flavour and well-blanched appearance.

Fordhook celery was somewhat late, with a good flavour, but the petioles, although thick, did not blanch well.

The local Chinese variety, which is normally grown for its leaves, had much thinner green petioles.

Table XV.

The Results of Two Celery Trials.

Variety.	Origin.	Total Yield in lbs.	Yield as Percentage of Mean.	Yield in lbs. per acre.
(Expt. C.H. 16/48)				
Fordhook ..	B	3,707	105	13,256
Golden Self-Blanching	C	4,107	116	14,687
Local Chinese ..	C	2,827	80	10,109
Mean ..		3,547	100	12,684
(Expt. C.H. 34/48)				
Golden Self-Blanching	C	2,220	81	16,117
Giant Pascal ..	C	3,170	115	23,014
Local Chinese ..	C	3,200	116	23,232
Golden Self-Blanching	B	2,455	89	17,823
Mean ..		2,761	100	20,046

In the second trial cut-worm and celery leaf-spot caused some patchiness in the crop and no yield differences attained satistical significance. Both the self-blanching varieties were of good quality but they appeared to be somewhat more susceptible to celery leaf-spot than the green varieties. This disease, however was kept in check by spraying with Bordeaux mixture.

The Giant Pascal Celery compared favourably with the green Chinese strain and it would be worth a second trial for the Chinese market.

The self-blanching types would probably be worth re-introducing but they should first be tested against similar Australian or English varieties.

MISCELLANEOUS.

Tomato. (Expt. C.H. 6/48).

This is a crop of very high value but is very expensive to grow and, because of its susceptibility to wilt *(Phytophthora infestans)*, it is always a most speculative crop. Chinese growers spray heavily with Bordeaux mixture every two or three days and, wherever possible, they make their beds on steep slopes. Virgin soil is preferred and seedlings are planted in pockets of burnt soil. On the Agricultural Station an airy site is usually chosen but it is considered inadvisable to crop such steep slopes as are planted by commercial growers because such a practice invariably results in severe erosion. For this reason, tomatoes rarely do well on the Station except in very dry weather. The varieties tested, their origin and yields are shown in Table XVI.

All plants were attacked by wilt at quite an early stage of growth and, although apparently healthy in the morning, they drooped on warm afternoons; this accounts for the low yield.

Both Burpee's and Clinton Hybrid were of outstanding quality with fruits about 8 oz. in weight, firm and of an excellent scarlet-red colour. The former had a slightly thicker wall and the latter was somewhat more vigorous and prolific.

Table XVI.

The Results of a Tomato Trial.

Variety.	Origin.	Total Yield in lbs.	Yield as Percentage of Mean.	Yield in lbs. per acre.
(Expt. C.H. 6/48)				
Burpee's Hybrid ..	B	294	76	6,098
Clinton Hybrid ..	B	541	140	11,222
Fordhook Hybrid ..	B	448	116	9,293
Jubilee ..	B	265	68	5,497
Mean ..		387	100	8,028

Fordhook Hybrid fruits were bright red, of medium size, and borne in large clusters. Flesh was firm and flavour slightly acid.

Jubilee fruits were large and golden-yellow in colour, with thick walls and few seeds. The flesh was somewhat dry and the flavour slightly acid.

In spite of the fact that seed of Hybrid American tomatoes is extremely expensive, the high quality of their fruit is quite sufficient to justify further trials.

Sweet Pepper or Capsicum. (Expts. C.H. 17/48 and 35/48).

There is a fair demand locally for Sweet Pepper, and the usual variety to be planted is Yates' Ruby King. Prices offered are good and a heavily-yielding crop can be very profitable. The varieties tested, their origin and yields are shown in Table XVII.

Table XVII.

The Results of Two Sweet Pepper or Capsicum Trials.

Variety.	Origin.	Total Yield in lbs.	Yield as Percentage of Mean.	Yield in lbs. per acre.
(Expt. C.H. 17/48)				
Early Pimento ..	B	1,073	117	19,475
California Wonder ..	G	578	63	10,491
Merrimack Wonder ..	B	1,203	131	21,834
Truhart Perfection ..	B	741	81	13,449
Ruby King ..	Y	982	107	17,823
Mean ..		915.4	100	16,614
(Expt. C.H. 35/48)				
Pimento Perfection ..	G	600	86	7,779
Ruby King ..		711	102	9,218
Early Pimento ..	B	789	113	10,229
Merrimack Wonder ..	B	739	106	9,581
Red Chili ..	C	701	100	9,088
California Wonder ..	G	659	94	8,543
Mean ..		699.8	100	9,073

In the first trial Burpee's Merrimack Wonder and Early Pimento gave heavier yields than Truhart Perfection and California Wonder. The

yield of Ruby King was also superior to that of California Wonder but no other differences were significant.

Merrimack Wonder and Early Pimento fruits were the best flavoured and each had a thick flesh. The former had a slightly superior flavour whereas the latter had a higher weight per volume.

No yield differences attained statistical significance in the second trial. The best quality fruit was yielded by Early Pimento, Merrimack Wonder and California Wonder.

Growers considered Early Pimento to be the best variety. Not only was the yield and quality good but the fruits were heavy and pendulous and appeared to be less likely to be attacked by fruit-rot in wet weather than the erect-fruited varieties.

Sweet Corn. (Expt. C.H. 8/48).

There is a good demand for sweet corn cobs but, until this trial was laid down, the crop was thought not to thrive at Cameron Highlands, hence no locally planted control variety was available. The varieties tested, their origin and yields are shown in Table XVIII.

Table XVIII.

The Results of a Sweet Corn Trial.

(Yields in lbs. and in cobs).

Variety.	Origin.	Total Yield in lbs.	Yield as Percentage of Mean.	Yield in lbs. per acre.
(Expt. C.H. 8/48)				
Top Flight Bantam ..	B	1,569	102	10,849
Stowell's Evergreen Hybrid ..	B	2,009	130	13,891
Golden Cross Bantam	B	1,048	65	7,246
Mean ..		1,542	100	10,662

Variety.	Origin.	Total Yield in cobs	Yield as Percentage of Mean.	Yield in Cobs per acre.
Top Flight Bantam ..	B	3,020	106	20,881
Stowell's Evergreen Hybrid ..	B	3,320	116	22,955
Golden Cross Bantam	B	2,200	77	15,211
Mean ..		2,847	100	19,682

Stowell's Evergreen Hybrid proved to be an outstanding variety and was superior to the other two both in yield and in numbers of cobs. Top Flight Bantam was also superior to Golden Cross Bantam.

All differences were highly significant. The quality both of Stowell's Evergreen Hybrid and of Top Flight Bantam was excellent; all grains were sweet, tender and evenly set in the cob. Those of the Hybrid variety were creamy yellow in colour, while the Top Flight Bantam cobs were pale golden yellow. Dealers were very impressed by quality and

growers were amazed by the vegetative vigour and even growth of the hybrid corn.

The evenness and uniformity of all varieties was reflected in the very low experimental errors.

Conclusions.

This series of experiments has revealed that the following varieties of vegetables, new to Cameron Highlands, are of outstanding quality or yield capacity and that their introduction would benefit the vegetable growing industry.

Vegetable.	*Variety.*	*Origin.*
Cucumber	Burpee's Hybrid	Burpee's
French Beans	Tender Green	„
	Dwarf Stringless Green Pod	Zwaan's
Beet	Lutz Green Leaf	Burpee's
Sweet Corn	Stowell's Evergreen Hybrid	„
Lettuce	Big White Boston	„
Chinese Cabbage (*Pe-tsai*)	Pe-tsai	„
Early Cabbage	Early Jersey Wakefield	„
	Glory of Enkhuizen	Govier
Celery	Golden Self Blanching	Burpee's or Govier
Sweet Pepper	Merrimack Wonder	Burpee's
	Early Pimento	„
Cauliflower	Burpeeana	„
Squash	English Vegetable Marrow White Bush.	Govier

Summary

Vegetable production at Cameron Highlands was almost entirely confined to the growing of cabbages but, owing to imports from other countries, there was a serious fall in price. The range of vegetables grown had clearly to be widened and a series of experiments to this end was started at Tanah Rata Agricultural Station. Trials with twenty types of vegetables are described and the conclusion reached that the permanent introduction of eleven of them would benefit the industry.

Acknowledgements.

These trials were initiated by Dr. A. E. S. McIntosh, Acting Director of Agriculture, who laid down the general lines on which they should be conducted.

Almost all the field work was carried out ably by Mr. Tan Ah King, Agricultural Assistant, Cameron Highlands, and he was also responsible for most of the notes on growth. Much of the credit for the success of the experiments is due to his hard work, careful recording of yields, and liaison with dealers and growers.

The writer was responsible for the statistical lay-outs, calculation of analyses of variance and for presentation of results.

MANURIAL EXPERIMENTS ON VEGETABLES AT CAMERON HIGHLANDS

BY

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AND

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Introduction.

It has been the experience of those who have grown vegetables at Cameron Highlands that to maintain a good physical structure in the soil and satisfactory crops therefrom, it is necessary to apply at least some organic manure. Compost has been found to be very beneficial at Tanah Rata Agricultural Station, but Chinese gardeners do not take kindly to compost making owing to the labour involved. An alternative is to supply mulch to the surface of the soil, but again there are objections that the material is difficult to find and that a mulch harbours cutworm. A mixture of compost and artificial fertilizers is a normal dressing at Tanah Rata Agricultural Station and has been used successfully by some smallholders, but almost all Chinese vegetable growers use prawn dust solely; and to cabbages, which are by far the most commonly grown vegetable, this manure is applied at the remarkably high rate of 1 lb. per plant.

Prawn dust is favoured by most growers because the transport which carries the crops to the plains brings back the prawn dust on the return journey. As might be expected, it is a very variable article, liable to contain a very high percentage of water, not to mention sand and the like. This unpleasant smelling material, suspected of breeding flies, used to be in evidence everywhere on the Highlands and measures were taken to prohibit its use in the residential area.

A garden fertilizer was evidently needed of fairly standard nutrient status, containing a sufficient proportion of organic matter to meet the requirements of vegetable growing. Messrs. Malayan Fertilisers, Ltd., were already supplying such mixtures to a certain extent, and were prepared to lay down comparative experiments with their fertilizers versus prawn dust.

The Experiments.

A series of three experiments was laid down in 1948 at three localities, the Agricultural Station, Tanah Rata, and smallholders' land at Ringlet and Brinchang, to determine whether the dressing of 5½ tons of prawn dust per acre (1 lb. per cabbage), could be replaced by a cheaper dressing of a combined organic-inorganic fertilizer mixture.

Each experiment consisted of five blocks, divided into four plots for the following manurial treatments:

A. Garden Fertilizer No. 3 at 2 tons per acre.
B. Garden Fertilizer No. 1 at 2 tons per acre.
C. Garden Fertilizer No. 2 at 2 tons per acre.
D. Prawn dust at 5½ tons per acre.

The fertilizer mixtures were stated to have the following analysis:—

Mixture	N	P_2O_5	K_2O	Organic Matter.
	per cent.	per cent.	per cent.	per cent.
GF 1	7.15	12.56	3.05	33
GF 2	7.00	12.50	3.05	35
GF 3	6.90	12.58	3.20	35

Each plot was split into three sub-plots for the three crops: cabbage, French beans and carrots. The manures were applied in two dressings, the first about 2 weeks after planting or sowing and the second some 3 to 4 weeks later. The total dressing for the cabbage plants was 6 ozs. of the garden fertilizer or 1 lb. of the prawn dust per plant. The method of application was to place the required dressings around each cabbage or French bean plant and then to fork it in lightly. The carrot plots had the manure broadcast and the crop was then swept and watered in order to wash the fertilizers off the foliage.

The area covered by the experiments varied at different localities, being 0.066 acre at Tanah Rata, 0.041 at Ringlet and 0.133 at Brinchang.

The Results.

Growth was satisfactory and the crops were free from serious attacks by pests or fungi. Some cut-worm attacks occurred in the carrot plots and perhaps 10 per cent. of the French beans were damaged by stem-borers. In the cabbage plots there were losses from stem rot varying from 26 per cent. at Ringlet, 6 per cent. at Brinchang and 2 per cent. at Tanah Rata.

The treatment totals and yields are summarised in Tables I, II and III.

In no case did either the differences between treatments or the interactions (treatment *x* crops) approach statistical significance. Yield differences between the different crops were very significant but of no experimental interest.

These three experiments indicate that there is nothing to choose between a dressing of 1.8 tons of garden fertilizer costing $450 per acre and a dressing of 4.8 tons of prawn dust costing $1,128 per acre, but it would be desirable to test the residual effect of the different fertilizers. An examination of the crop yields indicates that, in all three experiments, cabbage responded best to G.F.1; French beans to G.F.2 and carrots to G.F.3. The differences, however, were too small to give a significant interaction.

The soils at all three sites were in good heart and yields per acre very similar (18,637 to 22,246 lbs. per acre). Possibly an experiment carried out on less fertile soil would be valuable.

Table I.

Manurial Experiment at Tanah Rata (*Expt No. C.H. 26/48*).
Crop Totals (by treatments) in lbs. and Yields in lbs. per acre.

Crop.	Treatment.				
	B G.F.1	C G.F.2	A G.F.3	D Prawn Dust.	Mean.
Cabbage ..	2,455	2,395	2,402	2,312	2,391
French beans ..	447	485	406	369	427
Carrots ..	745	590	1,140	962	859
Crop Totals ..	3,647	3,470	3,948	3,643	3,677
Yield in lbs. per acre ..	22,064	20,994	23,885	22,040	22,246
Yield per cent. of mean ..	99	94	107	99	100

Table II.

Manurial Experiment at Ringlet (*Expt. No. C.H. 27/48*).
Crop Totals (by treatments) in lbs. and Yields in lbs. per acre.

Crop.	Treatment.				
	B G.F.1	C G.F.2	A G.F.3	D Prawn Dust.	Mean.
Cabbage ..	948	792	878	806	856
French beans ..	147	300	282	267	249
Carrots ..	621	608	813	726	692
Crop Totals ..	1,716	1,700	1,973	1,799	1,797
Yield in lbs. per acre ..	17,797	17,631	20,463	18,658	18,637
Yield per cent. of mean ..	96	95	110	100	100

Table III.

Manurial Experiment at Brinchang (*Expt. No. C.H. 28/48.*)
Crop Totals (by treatments) in lbs. and Yields in lbs. per acre.

Crop.	Treatment.				
	B G.F.1	C G.F.2	A G.F.3	D Prawn Dust.	Mean.
Cabbage ..	1,082	1,048	1,001	955	1,022
French beans ..	219	249	236	222	232
Carrots ..	352	400	600	560	478
Crop Totals ..	1,653	1,697	1,837	1,737	1,732
Yield in lbs. per acre ..	20,001	20,534	22,228	21,018	20,945
Yield per cent. of mean ..	96	98	106	100	100

Summary.

The standard manure in Cameron Highlands, where many vegetables are grown, was prawn dust, but owing to its unpleasant smell and the suspicion that it was breeding flies, its use in residential areas was prohibited. Experiments were therefore conducted with certain garden fertilizers to determine whether they could take the place of prawn dust. The experiments showed that with cabbage, French beans and carrots, similar yields could be obtained for a smaller expenditure.

Acknowledgements.

Our thanks are due to the Director, Malayan Fertilisers Ltd., who provided the garden fertilizers and to the smallholders on whose land the experiments were conducted.

THE VEGETATIVE PROPAGATION OF COCOA

By
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Seedling trees of cocoa, in common with seedling trees of most plantation crops, show considerable variation in type and fruiting capacity, and it is desirable when planting an area with cocoa that the trees should be as high yielding and as uniform as possible. To enable this to be accomplished the vegetative propagation of good type high yielding trees is essential.

Definitions.

For those to whom cocoa is a new crop, the following are definitions of terms used in connexion with cocoa throughout this article.

Chupon or Watershoot.

Cocoa trees exhibit two forms of branching, the first type normally growing vertically with the leaves arranged spirally on the stem. This type of branch is known as a chupon.

Fan.

A chupon, after having grown vertically for a certain distance, produces out of its apex a number of horizontal branches on which the leaves are arranged, not spirally, but in one plane and in pairs opposite one another. This type of branch is known as a fan branch.

Stooling.

Stooling is a method of vegetative propagation in which an established tree is cut back to within a few feet of the ground. This pruning back causes a number of chupons to arise at the base of the tree; these are earthed up and after some months produce roots of their own, after which they can be removed and planted.

Petioled Budwood.

Petioled budwood is budwood on which the leaf petioles, or stems, have abscissed and dropped off, leaving a healed scar immediately below the bud, which normally forms in the apex of the leaf petiole and stem.

Modified Forkert System of Budgrafting.

In this system of budgrafting a rectangular bud patch is used. A transverse incision is made in the bark of the stock as far as the cambium, and the bark is then peeled down to a depth of about 1 inch. Two-thirds of the flap so formed are cut off, and the bud patch is then inserted in position and tied in place with the remaining third of the bark flap covering the lower part of the bud patch.

Vegetative Propagation.

The vegetative propagation of cocoa was first undertaken early in the century, (1 and 2) the method used being budgrafting. Later, marcotting was tried with some success. (3). In 1930 Pyke (4) working in Trinidad was successful in stooling cocoa and in producing softwood cuttings. Later workers have concentrated on softwood cuttings and on budgrafting for propagation work.

Budgrafting.

One of the earliest authoritative accounts of budgrafting in Java was given by Stahel (5), using the oval bud patch method of budgrafting. Budding was performed either in the field, in which case the stocks were 2 to 2½ years old, or in a nursery, where younger stocks about 1½ years old and with their stem about 1 in. in diameter were used. Stahel stressed the importance of using budwood sufficiently mature, and preferred chupon buds rather than fan buds, since chupon buds produced a better type of tree. He noted that frequently buds, although taking well, took some months to shoot, and finally evolved a system whereby the stocks were tied down in an arch subsequent to the bud patch having formed a good union with the stock; such treatment encouraged rapid shooting of the bud.

Pyke, in the fourth annual report of cocoa research (6) described the budgrafting method as developed in Trinidad. He stated that budding is best done when the stocks are a year old, about pencil thickness. Furthermore he stresses that for the best results budwood must be petioled, either artificially by severing the leaf petiole some three weeks prior to using the budwood, or naturally. Heavy shade over the stocks at the time of budgrafting is not desirable. Incompatibility is said to occur quite frequently. Where chupon buds are available they may be budgrafted on to large stocks with good results.

One of the most serious drawbacks when using buddings as planting material is the tendency for the stock to send up numerous watershoots from below the junction with the scion. Such watershoots will consist of unselected seedling material, and have frequently to be pruned off.

Cuttings.

In the fifth annual report of cocoa research, Trinidad, (7) Cheesman and Spencer summarized the work undertaken by Pyke on propagation of cocoa by cuttings. The cuttings used were all of the softwood type; that is they were young flushes which had just hardened. The type of special solar propagator used was described, together with the technique for potting and hardening. Briefly, the propagators consisted of concrete bins 3ft. long, 2ft. 6 ins. wide, of height 3ft. at the back and 2ft. 10ins. at the front, covered with glazed lids. They were protected by overhead shade of hessian cloth, and the bin lids were covered by a layer of fine cheese-cloth. The propagating medium consisted of coarse river sand. Cuttings placed in these propagators and watered suitably rooted in

PLATE I.
Chupon cutting.

PLATE II.
Fan cutting.

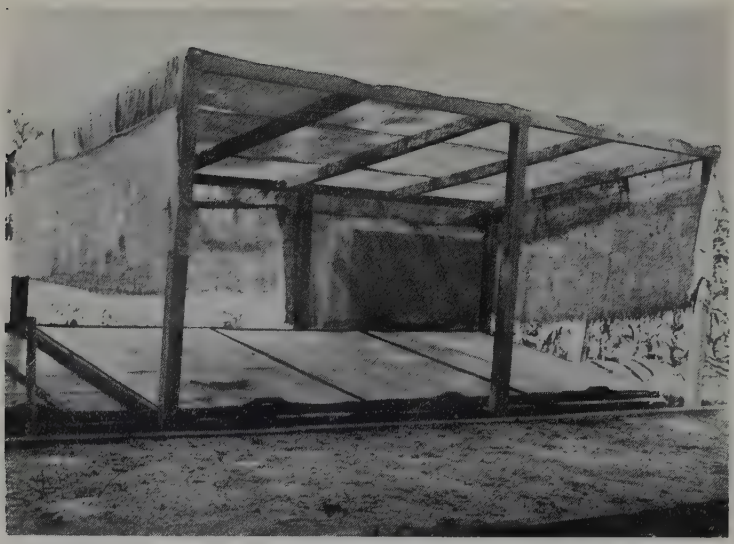

PLATE III.
Propagating bins.

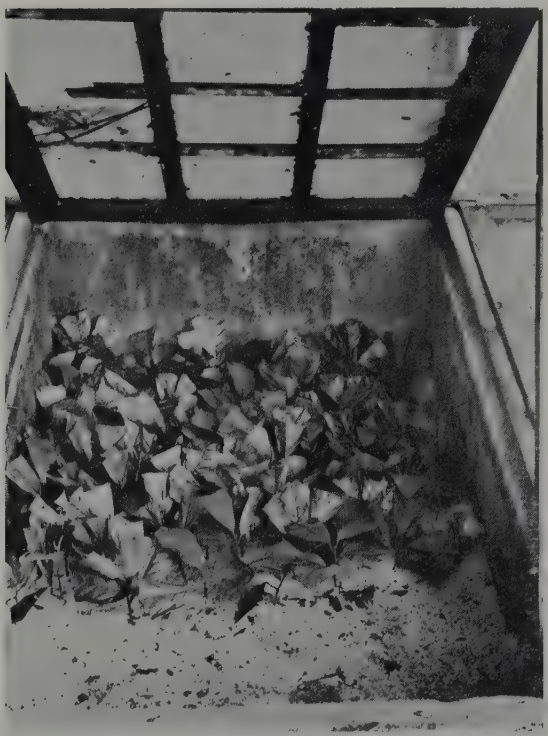

PLATE IV.
Cocoa cuttings in propagating bins.

3 to 4 weeks. It was observed that under normal conditions mature cocoa trees produced very few cuttings of the desired type, and it was therefore suggested that, where large scale production of cuttings was desired, special cutting wood areas should be established from budded trees, which would be manipulated and manured in such a way that a constant succession of suitable cuttings would be produced by judicious pruning.

Bowman (8) described a modification of this technique for root cuttings without the use of special propagators. A suitable propagating medium was obtained by excavating a shallow ditch which was then filled with 9 to 10 ins. of sand and left unshaded. Softwood cuttings were dipped in a root growth-promoting hormone and placed in the sand bed at 4 x 4 ins. spacing. They were then sprayed with a fine spray of water during the daylight hours for the first 3 or 4 weeks. After this the rooted cuttings were removed and placed in shaded beds of ordinary soil, and sprayed again for 6 to 8 days, the length of the spraying period being reduced daily. It was claimed that good rooting percentages could be obtained in this way. The disadvantage of the system is the necessity for having a piped water supply laid on.

Experiments.

Preliminary trials on the rooting and establishment of cocoa cuttings and the budgrafting of cocoa seedlings, following the methods outlined above, have now been concluded at the Federal Experiment Station, Serdang, and the results obtained are tabulated below.

BUDGRAFTING.

Table I shows the results obtained as a result of budgrafting 100 seedlings with unpetioled and petioled budwood.

Table I.

Results Obtained by Budgrafting Cocoa Seedlings.

Type of Budwood.	No. of Seedlings Budded.	No. of 'Takes' after 17 Days.	No. of Buds Shot after 6 Weeks.	No. Matured after 3 Months.	Percentage Success.
Unpetioled budwood.	50	38	27	22	44
Petioled budwood.	50	36	32	19	38

The modified Forkert system of budgrafting was used, with budwood taken from mature cocoa trees. This budwood consisted of young flushes which had just hardened. The seedlings were 9 to 12 months old, with the stems about pencil thickness, and in an active state of growth.

After the budgrafting operation had been carried out the bud patches were bound with raffia, and 17 days later the raffia was removed. A fortnight later the seedlings were pruned, leaving about 6 ins. of stem and

two or three leaves above the bud patch. After 6 weeks a final pruning was carried out to just above the bud union and the cut surface protected by paint.

It was observed that there was little difference in the percentage success obtained with petioled or unpetioled budwood, except that the bud patches from petioled budwood shot rather more rapidly than those from unpetioled budwood. These latter were very slow to shoot, and hard pruning was undertaken to encourage growth of the bud patch. From observations it would appear probable that more rapid shooting would be obtained if the seedlings were tied down in a loop after the raffia had been opened, as suggested by Stahel.

Cuttings.

The method of striking used followed exactly the lines suggested by Pyke at Trinidad. The propagating bins were 5ft. 6ins. long x 3ft. 6ins. wide, and were 3ft. deep. The rooting medium consisted of a layer of very coarse sand to a depth of 2ft. No drain-off was used, the depth of sand being relied on to give adequate drainage.

The bin lids (glass frames) were covered by a sheet of fine white cloth, and, on a wooden and wire framework erected about 4ft. above the bins, coarse hessian cloth was stretched. This cloth was also brought down the sides of the framework to give protection from lateral light. (Plate III).

In all cases the cuttings selected were of young wood, being either chupon or fan shoots which had just finished an active growing period. In such cuttings the stem at the tip is still green, but begins to turn brown 6 to 12 ins. below the tip.

The procedure followed was to cut the shoots about 12 to 18 ins. long and to bring them in bunches of 20 to the bins. There the lower leaves were removed and the leaves remaining were cut approximately in half to reduce the amount of transpiration. Finally, immediately prior to setting in the sand, the shoots were cut down to 9 to 15 ins. and the cuttings set in the sand about 3 ins. deep and about 6 ins. apart. (Plate IV). They were immediately watered and subsequently watered four times a day, i.e. at 6 a.m., 11 a.m., 2 p.m., and 6 p.m.

The bin lids were kept permanently closed, except during watering, for a period of five weeks after setting the cuttings in the sand. After five weeks the cuttings were lifted and if root development was satisfactory, were planted in 9-inch baskets in good potting soil. They were then replaced in the bins and the lids kept closed for another week. During the 7th week the lids were opened from 6 a.m. to 9 a.m., the 8th week from 6 a.m. until 11 a.m. and thereafter the lids were kept open permanently and watering reduced to once a day. After four months the basketed cuttings were taken out of the bins and placed under atap shelters.

No particular difficulty was experienced throughout the whole period. When the cuttings were first lifted after 5 weeks, the amount and degree of rooting varied considerably, but most of the cuttings had calloused well.

Those which had not calloused were discarded immediately. Only three cuttings died after having been basketed. Preliminary results obtained by the use of growth promoting hormones indicate that the period required for striking can be reduced from 5 weeks to 3 or 4 weeks.

Table II.

Results Obtained from Cuttings.

Bin No.	No. of Cuttings Planted.	Date 1948.	No. of Cuttings Established in Baskets.	Date 1948.	Percentage Struck.
I	20	21st Aug.	15	21st Dec.	75
II	26	27th „	21	„ „	81
III	21	28th „	20	„ „	95

Note: Bin I consisted of a mixed batch of chupon and fan cuttings.
Bin II consisted of chupon alone.
Bin III consisted of fans alone.

This preliminary trial indicates that no particular difficulty should be experienced in Malaya in the striking of cocoa cuttings. On a large scale, various refinements should be made to the bins to reduce the amount of labour required for maintenance.

Summary.

An account is given of the budgrafting of cocoa and the establishment of cuttings. Budgrafting presents little difficulty, although the bud patches are rather slow to shoot. Vegetative propagation by cuttings is simple provided suitable propagating bins are available.

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(8) Cocoa Information Bulletin. Inter-American Institute of Agricultural Science, Turrialba, Costa Rica. Vol. I. No. 5.

EXPERIMENTS ON THE CULTIVATION OF GROUNDNUTS, 1947-49

By

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and

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The area under groundnuts in Malaya has never been very large and before the war barely 2,000 acres were recorded. Since the war, although the area planted has increased in certain districts (notably in parts of Kedah and Malacca), the total acreage has not reached very much greater proportions. Net imports of groundnuts exceeded 11,000 tons in 1940 and 9,000 tons in 1948. It is thus clear that there is a big local demand which might well be met by increased local production.

Between 1947 and 1949 a number of experiments were carried out on Agricultural Stations to obtain information on methods of cultivation and manuring, and the results of these experiments are summarised in Table I. Although the experiments have been somewhat restricted in scope, owing to pressure of more important investigations, the results do present information on certain aspects of the cultivation of this crop which was not hitherto available.

The results are discussed below under the headings of the factors which have been under investigation. The results of experiments on padi land are discussed separately.

(1) *Varieties.*

Variety trials have shown that considerable differences exist in the yielding capacities of the varieties of groundnuts grown in Malaya. At the Federal Experiment Station, Serdang, the variety Kedah has yielded more heavily than either the Serdang variety or an imported Siam variety, while in Penang, the Perak and Kedah varieties yielded more heavily than the Siam variety. It would appear probable that better varieties are still available locally and further trials will be necessary to test them. It is also probable that yields can be improved by plant selection which is now being undertaken.

(2) *Planting Distance.*

Experiments have shown that the optimum planting distance is 1 x 1 ft., (43,560 plants per acre) where square planting is undertaken; the amount of seed required to plant an acre, at two seeds per point, and 1 x 1 ft. planting, is a little over 100 lbs. Where mechanical cultivation of the crop is envisaged, a planting distance of drills 2 ft. apart, with plants spaced 6 ins. in the drills might be more effective.

(3) *Planting on Beds versus Planting on the Flat.*

It has been shown in these experiments, in which there was adequate drainage, that there was no advantage in planting on beds as against planting on the flat.

(4) *Maturation Period.*

In a trial with the variety Kedah, it was found that the optimum maturation period was 100 days. There were no significant differences in yield between harvestings at 90, 100, 110 and 120 days, but at 90 days there was a large number of immature nuts, while at 110 and 120 days many of the nuts had started to germinate. The yield at 100 days was the greatest.

(5) *Manuring.*

(i) *Lime.* Although applications of lime on coastal alluvium (padi) soils have given striking responses (see below) there is as yet no experimental evidence of response to lime on inland soils. However, one pre-war single plot trial and much experience suggest that positive responses are normal. On land manured at 30 cwts. ground limestone per acre a year previously, the further application of lime produced no increase in yield. (Experiment 5).

(ii) *Potash and Phosphate.* An experiment carried out on land in a high state of fertility gave no response to the application of either phosphate or potash.

(iii) *Cattle Manure.* There is evidence to show that the application of cattle manure to limed plots causes a depression in yield. The results of Experiments 5 and 6, planted almost simultaneously on adjacent land, lend support to this. In Experiment 6 cattle manure was applied, whereas in Experiment 5 no cattle manure was applied. It will be noticed that, while in Experiment 5 the yield of the variety Kedah in all treatments is over 1,000 lbs. of dry seed per acre, in Experiment 6 this variety yielded only 348 lbs. per acre.

(6) *Yields.*

The later experiments carried out at Serdang have all been conducted on an area of land given over to vegetable production, and for such crops dressings of between 10 to 20 tons of cattle manure per acre per crop are applied. The fertility of the land has, under these conditions, been gradually increasing, and groundnut yields of between 1,000 and 1,250 lbs. of dry seed per acre can now be obtained without the application of any manure. On less fertile ground it is probable that yields between 600 and 1,000 lbs. of seed would be obtained with the use of lime and artificial manures. It should however be noted that shelling percentages have varied widely (from 49 to 77 per cent.) though the average figure has been about 65 per cent.

The yield of groundnuts is apparently controlled to a considerable extent by the distribution of rainfall over the growing period. An evenly distributed rainfall for the first 40 to 50 days of growth, with drier

Table I.

Groundnut Experiments, 1947—49.

No.	Soil.	Lay-out.	Treatments.	Yield in lbs. per acre. Dry Unshelled Nuts.	Yield in lbs. per acre. Dry Seeds.	Results.
	A. *Federal Experiment Station, Serdang.*					
1	Valley quartzite	6 randomised blocks of 3 treatments.	Spacing 6 in. x 6 in.	893	691	Severe rat damage.
			9 in. x 9 in.	629	551	Differences insignificant.
			12 in. x 12 in.	668	454	
2	„	3 randomised blocks of 2 treatments with split plots for 3 varieties.	Planted on the flat	758*	493	Bed v. flat insignificant.
			Planted on beds	586	381	Kedah significantly > Local or Siam.
			Varieties Siam	460	299	
			Local	704	458	
			Kedah	851	553	
3	„	4 randomised blocks of 2 treatments with split plots for three spacings.	Planted on the flat	955	718	Bed v. flat insignificant.
			Planted on beds	1,375	650	1 ft. x 1 ft. Significantly > 1½ ft. x 1½. >2 ft. x 2 ft.
			1 ft. x 1 ft.	1,863	911	
			1½ ft. x 1½ ft.	1,279	684	
			2 ft. x 2 ft.	1,517	457	
4	„	4 randomised blocks of 4 treatments.	Harvesting at A. 90 days	2,090	1,224	No significant differences but high proportion of immature nuts at 90 days and increasing numbers of germinated seeds at 110 and 120 days.
			D. 100 „	2,159	1,348	
			B. 110 „	2,049	1,238	
			C. 120 „	1,898	1,155	
5	„	3 x 3 x 3 factorial experiment, 27 plots.	Manurial treatments:—			
			Gr. limestone 0 cwts/acre	1,853	1,067	No significant differences.
			30 „ „	1,797	1,051	
			60 „ „	1,788	1,067	
			Muriate of potash 0 „ „	1,815	1,069	
			1½ „ „	1,895	1,060	
			3 „ „	1,727	1,056	
			Superphosphate 0 „ „	1,871	1,115	
			1½ „ „	1,769	1,046	
			3 „ „	1,797	1,023	
6	„	6 randomised blocks of 2 varieties.	Varieties Kedah	719	348	Difference insignificant.
			Local	684	333	Cattle manure only was applied.

Table 1. (Contd.)

Groundnut Experiments, 1947—49.

No.	Soil.	Lay-out	Treatments.	Yield in lbs. per acre. Dry Unshelled Nuts.	Dry Seeds.	Results.
	B. *Ayer Itam Agricultural Station, Penang.*					
7	Granite	12 randomised blocks of 3 varieties.	Varieties Perak Kedah Siam	558 567 343	379 388 226	Perak and Kedah significantly >Siam.
8	„	6 randomised blocks of 2 varieties with split plots for manurial treatments.	Variety Siam No. F.Y.M. „ „ FYM 10 tons „ Local No F.Y.M. „ „ FYM 10 tons 20 piculs lime per acre to all plots.	642 474 1,122 831	392 275 718 524	Local significantly >Siam. Cattle manure significantly depressed yield.
	C. *Bukit Merah Padi Station, Province Wellesley.*					
9	Coastal Clay	6 randomised blocks of 2 treaments with split plots for manurial treatments.	Flat v. bed Manurial treatments:—	Flat Bed.		
			Control (O)	110 234	172 344	Beds significantly >flat.
			Buffalo manure 5 tons/acre	232 569	401 261	L30 & L30 +FYM significantly >L10, L20, FYM, O.
			Lime 10 cwts/acre	445 614	529 112*	
			Lime 20 cwts/acre	498 671	585 380	L20 — L10 significantly >FYM, O.
			Lime 30 cwts/acre	674 802	737 479	FYM significantly >O.
			Lime 30 cwts. plus FYM 5 tons/acre.	652 1,047	840 546	
				435 656	544	
10	„	5 x 5 Latin Square.	A groundnut treatment in an off-season vegetable experiment 30 cwts. lime/acre.	1,948 = 855 1,949 =	556*	Groundnuts planted with 30 cwts. of lime caused an increase of 24 per cent. in the padi crop in 1949. Similar increases obtained by cultivation of sweet potates with and without manure.

* Estimated at 65 per cent. shelling percentage. Actual figures not available.

conditions for the last 50 days appears to give a maximum yield. Groundnuts should thus be planted toward the end of the wet season and harvested during the dry season.

Groundnuts as an Off-Season Crop on Padi Land.

A pre-war experiment (1) at Bukit Merah in Province Wellesley had shown that: (1) in a season in which heavy rain was not experienced, as high a yield was obtained from planting on the flat as from planting on beds; (2) lime was essential and, when applied at the rate of 30 cwts. per acre, increased the yield of unshelled groundnuts by over 200 per cent.; and (3) buffalo manure applied to limed plots further increased yields by over 20 per cent. The effects on the subsequent padi crop were not ascertained owing to the war.

This experiment was repeated at Bukit Merah in the 1947 off-season with the addition of two lime treatments at lower rates, viz. 10 and 20 cwts. per acre. The results are shown in Table I as Experiment 9. Lime was less effective at the lower rates. In this season, during which heavy rain fell, the beds proved their value and the yield obtained from them was 50 per cent. greater than from the plots in which the groundnuts were planted on the flat. On the beds, buffalo manure applied to the limed plots again had an effect, but under the adverse conditions on the flat it had no effect. It will be noted that the treatment yields on beds are almost exactly the same as those obtained in 1941. Unfortunately in this experiment the subsequent padi crop was so badly damaged by rats that no results could be obtained.

In the 1948 off-season the lime treatment giving the best return in the previous experiment was included in a comprehensive off-season cropping experiment which is to run for many years. An average of 855 lbs. per acre of unshelled groundnuts was obtained from these plots and in the subsequent padi crop an increased yield of 24 per cent. was obtained over plots uncultivated in the off-season. Similar increases were, however, obtained from the cultivation of sweet potatoes with and without manure so that, for the present, it is only possible to conclude that the increased padi yield is due, as previously shown (1), to off-season cultivation and not to the effect of liming or to the growing of groundnuts.

Summary.

In groundnut experiments recently carried out it has been shown that:

(1) Strains exist in Malaya showing markedly different yielding abilities.

(2) There is no advantage in planting groundnuts on beds except where, as in padi fields, water logging may be expected.

(3) The optimum spacing for Malayan varieties is 1 ft. x 1 ft.

(4) The Kedah variety should be lifted at 100 days.

(5) On coastal clay padi soils lime up to 30 cwts. per acre gives a marked increased in yield; on inland soils there is some evidence

of response to lime but where an annual crop is taken annual dressings do not appear to be necessary.

(6) On limed plots cattle or buffalo manure has depressed yields on inland (granite) soil, but has increased yields on padi soil where the groundnuts were planted on beds.

(7) No response has yet been obtained to phosphate or potash on inland (valley quartzite) soil.

(8) Cultivation of groundnuts in the off-season on padi land has led to a similar increase in the padi yield as has been obtained by the cultivation of other foodcrops.

References.

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THE EFFECT OF A POTASSIUM MAGNESIUM FERTILIZER ON THE YIELD OF OIL PALMS ON HILL QUARTZITE SOIL

Compiled from Records and Notes left by the late Mr. A. B. Lucy,

by

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Manurial experiments on oil palms carried out before the war at the Federal Experiment Station, Serdang, and on a number of estates failed to show any positive response to potash manures (1). It had been thought that potash might reduce the bronzing and wilting of the leaves which was a common occurrence, particularly on quartzite and peat soils. No beneficial effects resulted from potash applications however, but reports from Sumatra stated that a compound potash-magnesium fertilizer had reduced bronzing in that country.

In 1939 it was decided, therefore, to lay down an experiment with a potassium and magnesium fertilizer, and a brief mention of this experiment was made in this Journal (2) where it was recorded that the fertilizer, in addition to causing a reduction of wilting and bronzing, also showed signs of increasing yields.

The manure used was "patent kali," a proprietary fertilizer with the following analysis:

Moisture	3.50 per cent.
Potash (as K_2O)	29.61 ,, ,,
Magnesium (as MgO)	9.82 ,, ,,

Lay-out.

The area chosen was on hill quartzite soil and had been planted 30 x 30 ft. triangular in 1930. The system of cultivation up to 1938 was to slash back the undergrowth three times a year. The leaves of many of the palms were showing bronzing and wilting. The experiment consisted of four randomised blocks of two main cultivation treatments, clean weeding and planting with the creeping cover *Pueraria phaseoloides*.

Each plot was divided into two sub-plots one of which was to receive an application of 6 lbs. patent kali per tree per annum. The *Pueraria* was established only with difficulty and up to the end of 1941 there was no difference between the main treatment yields. For the purposes of this note therefore the original main-plot treatments are being ignored, and the experiment is regarded as one consisting of eight randomised blocks with two treatments, control and patent kali. Each plot contained 20 trees. There were guard rows between blocks but not between plots within the blocks.

Table I.

Yield of Fruit Bunches from Plots of 20 Palms, 1939 and 1940.

Block	1939						1940					
	CONTROL.			PATENT KALI.			CONTROL.			PATENT KALI.		
	No. of Bunches	Wt. of Bunches in lbs.	Average Bunch Wt. in lbs.	No. of Bunches	Wt. of Bunches in lbs.	Average Bunch Wt. in lbs.	No. of Bunches	Wt. of Bunches in lbs.	Average Bunch Wt. in lbs.	No. of Bunches	Wt. of Bunches in lbs.	Average Bunch Wt. in lbs.
1	261	3,242	12.4	263	4.147	15.7	193	3,954	20.5	251	6.180	24.6
2	241	3,341	13.9	260	3,598	13.8	189	4,042	21.4	222	4,745	21.4
3	235	3,188	13.5	274	4,315	15.7	204	3,764	18.4	197	4,904	24.9
4	239	3,513	14.7	259	3,569	13.7	180	3,726	20.7	212	4,262	20.1
5	243	3,390	14.0	318	4,580	14.4	202	3,785	18.7	249	5,760	23.1
6	309	6,052	19.6	189	3,051	16.1	184	4,401	23.9	225	5,328	23.7
7	216	3,259	15.0	248	5,486	22.1	199	4,383	22.0	195	5,683	29.1
8	276	5,336	19.0	146	2,099	14.4	235	5,635	23.9	199	4,497	22.6
Total	2,020	31,321	—	1,957	30,845	—	1,586	33,690	—	1,750	41,359	—
Mean	253	3,915	15.3	245	3,856	15.7	198	4,211	21.2	219	5,170	23.7

Manurial Treatment.

All palms received an application of 4 lbs. Christmas Island rock phosphate in May, 1939, and at the same time 6 lbs. of patent kali per tree was applied to the patent kali plots. The manures were broadcast evenly over the whole plots except that the space between the adjoining rows of the two plots within each block was left unmanured. The applications of patent kali were made in May 1939, June 1940 and May 1941. The rock phosphate applications on all plots in 1940 and 1941 were made in October.

Health of the Palms.

No difference in the health of the palms was noticed until September 1940, 16 months after the first application of patent kali. It was then noticed that on the majority of patent kali plots the leaves had become appreciably greener. These differences became more clearly marked in early 1941, although the leaf yellowing and premature withering was still far from cured. At the same time the fact that these plots were giving a heavier crop could be clearly seen.

Table II.

Mean Monthly Yields of Fruit Bunches from Plots of 20 Palms, 1940.

Month.	Control lbs.	Patent Kali.	
		lbs.	Percentage of Control.
January ..	148	194	131
February ..	304	428	140
March ..	327	321	98
April ..	702	694	98
May ..	590	609	103
June ..	308	400	129
July ..	298	355	119
August ..	534	627	117
September ..	358	549	153
October ..	311	465	149
November ..	215	315	146
December ..	115	212	184
Mean 1940 ..	351	431	123
Mean 1939 ..	326	321	98

Yield.

Table I shows the yield of bunches (number and weight) during 1939 and 1940. The weight of bunches harvested in 1940 from the patent kali plots is significantly greater than from the control plots. It will be seen that in 1939 there was no significant difference between treatments either in bunch number or weight. In 1940 the patient kali plots gave a larger number of bunches and a higher weight per bunch than the control plots. Although there had been, during 1940, a general increase in weight per bunch (possibly due to the effect of cultivation in 1939) this was more

marked in the treated plots where it resulted in an increased yield of 34 per cent. in spite of a drop in the number of bunches. In the control plots the increase in yield over 1939 was only 8 per cent. Table II shows the monthly yields during 1940. Though some increased yield was shown in the early months it is clear from the figures that a more or less permanent increase was not apparent until the middle of the year.

Acknowledgement.

I am indebted to Mr. H. D. Matheson, Agricultural Officer, for carrying out the statistical analysis.

References.

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(2) Georgi, C. D. V. Ash from Coconut and Oil Palm Waste Products as a Substitute Potassium Fertilizer. *Malayan Agricultural Journal*, Vol. XXIX, November, 1941.

MECHANIZATION

Quarterly Progress Report, October to December, 1949.

Compiled by the Acting Senior Agricultural Officer (Research)

Recent Importations.

The following implements were received during the period under review:—

Steel front and rear wheels for Field-Marshall tractor, together with extension rims.

16 ins. single-furrow digger-plough for Ferguson tractor.

Ransomes Polydisc, a twelve-disc harrow-plough.

Deere-Killefer hydraulic-controlled chisel-cultivator, with bedding and furrowing attachments.

Tests and Modifications.

Continued wet weather for the past three months has held up progress in all areas. On the dry-land Federal Experiment Stations at Serdang and Port Swettenham, there were virtually no days on which efficient heavy cultivation could be done but on Padi Stations some work was possible where drainage could be adequately controlled.

KELANTAN.

A Trusty cutter-bar is being mounted on a Farmall A tractor in the hope of being able to use it as a "header", threshing to be done subsequently by a Midget thresher.

PROVINCE WELLESLEY.

Ferguson Tractor.

The Ferguson which has done well in both wet and dry conditions in Kelantan was tested in the only available area at Bukit Merah. Water had been standing for a long period and the land was water-logged. The first trials were carried out using standard front pneumatics and locally made steel extension wheels. These wheels proved to be a failure and the tractor became completely bogged even when moving without an implement. The next trial was made using pneumatic tyres and girdles. In this case the narrow section front pneumatic wheels sank up to the hubs and after progressing for about 25 yards the tractor became bogged. The girdle-shod rear wheels showed promise but the girdles, as fitted, were allowed to "creep" relative to the tyre to aid self-cleaning; this, unfortunately, precluded the possibility of the standard procedure of de-bogging with a pole. A further trial was carried out with double pneumatic tyres, both front and rear. Although some success was obtained, the area contained many very soft patches and the tractor constantly became bogged. The twin front pneumatics were entirely satisfactory and gave promise of solving the problem of front-end support; steering was

unaffected and no undue sinking occurred even in very soft patches. The rear-end performance was disappointing but in view of the advantages to be gained from the use of all-round pneumatics further trials will be conducted.

Ransomes M.G.2.

The Ransomes M.G.2 was tried in the padi fields after being modified by the addition of swamp-blocks fitted to every other track shoe, an extension to the exhaust pipe, and scraper bars at the forward end of the tracks. It was tested with both its single-furrow and two-furrow plough and did good work in extremely difficult conditions. When disc-harrowing it was considered to be rather under-powered as the disc-harrows constantly choked-up. With locally made "Kedah" and "Drum" rollers good work was done early in the season when the land was fairly hard but later, when it became worked-down and very soft, a bow-wave of mud formed in front of the implement which on occasions brought the tractor to a standstill. In general the M.G.2 proved to be capable of operating under almost any conditions met with in the coastal clay wet padi areas but the speed of work was slow and power was sometimes lacking.

General.

Experiments on Estates.

It is the policy of the Department of Agriculture, wherever there is at any time machinery from its limited supply, surplus to immediate requirements for padi mechanization investigations, to conduct experiments into mechanical cultivation on estates, provided that the managements are prepared to co-operate fully (to include payment of running costs and transport of machines) and to submit regular and accurate figures for the yields of the plots concerned in the experimentation. In continuation of this policy, arrangements have been made to lay down trials on a coconut and an oil palm estate in Selangor.

Costs of Mechanical Operations.

It will be appreciated that in writing articles for the *Malayan Agricultural Journal* it is necessary to have standards on which to work so that costs may be readily compared. These standards and the method on which the costs are calculated were given in the January, 1948, number of this Journal. In order that comparison might be made with previously published figures, all costs published since that time have been calculated according to this basis. Since then, however, prices have risen somewhat; furthermore the recent devaluation of the pound has resulted in a still more important rise in the cost of American tractors, which will be reflected in the cost of work per hour. It is therefore necessary to alter the figures on which running costs are based to the following, which are the prices and wage rates ruling on 1st January, 1950.

Table I.

Costs of some Typical Mechanical Cultivations. (Calculated).

(per hour and per acre).

No.	Operation.	Type of Fuel Used.	Running Costs.			Overhead Costs.						Total Cost per hour.	Area Cultivated per hour.	Running Cost per acre.	Total Cost per acre.
						Tractors.			Implements.						
			Fuel.	Labour.	Total Running Costs.	Depreciation 10,000 hours.	Repairs and Maintenance 100 p. cent	Total Overheads on Tractors.	Depreciation 10,000 hours.	Repairs and Maintenance 50 p. cent	Total Overheads on Implements.				
			$	$	$	$	$	$	$	$	$	$	acres.	$	$
1.	"Caterpillar D. 8" with Dozer blade removing rubber. (*M.A.J. 31*, 52). ..	Diesel	2.71	0.88	3.59	6.33	6.33	12.66	—	—	—	16.25	1.0	3.59	16.25
2.	"Caterpillar D. 4" with 3-furrow disc-plough in heavy *belukar. (M.A.J. 31, 61)* ..	Diesel	1.24	0.81	2.05	2.00	2.00	4.00	0.07	0.04	0.11	6.16	0.2	10.25	30.80
3.	"Field Marshall" with heavy disc-harrow in fair conditions, single cultivation. ..	Diesel	0.64	0.56	1.20	0.63	0.63	1.26	0.07	0.04	0.11	2.57	1.6	0.75	1.61
4.	"Fordson" with 2-furrow mould-board plough in fair conditions. (*M.A.J. 32*, 146).	Kerosene	1.57	0.90	2.47	0.39	0.39	0.78	0.06	0.03	0.09	3.34	0.5	4.94	6.68
5.	"Fordson" with 2-furrow mould-board plough in wet conditions. (*M.A.J. 32*, 146).	Kerosene	2.62	1.15	3.77	0.39	0.39	0.78	0.06	0.03	0.09	4.46	0.4	9.42	11.60
6.	"Fordson" with light disc-harrow in fair conditions, single cultivation. ..	Kerosene	1.31	0.90	2.21	0.39	0.39	0.78	0.06	0.03	0.09	3.08	2.0	1.11	1.54
7.	"Farmall A" with 2-furrow disc-plough in medium conditions.	Kerosene	1.25	0.90	2.15	0.51	0.51	1.02	0.05	0.03	0.08	3.25	0.3	7.17	10.83
8.	"Farmall H" with 3-furrow disc-plough in fair conditions.	Kerosene	1.25	0.90	2.15	0.60	0.60	1.20	0.07	0.04	0.11	3.46	0.6	3.58	5.77
9.	"Ferguson" with 2-furrow mould-board plough in fair conditions. ..	Petrol	1.91	0.90	2.81	0.39	0.39	0.78	0.04	0.02	0.06	3.65	0.5	5.62	7.30
10.	"Ransomes M.G. 2" with single-furrow plough in wet conditions. ..	Petrol	0.66	0.85	1.51	0.26	0.26	0.52	0.03	0.02	0.05	2.08	0.16	9.44	13.00

	$	
Petrol	1.52	per gallon.
Kerosene	0.91	,, ,,
Diesel oil	0.60	,, ,,
Lubricants	3.50	,, ,,

	$	
Operators, Class I. Standard Rate $3.00 per day plus $1.12 C.O.L.A.* = $4.12 per day ..	0.63	per hour.
Operators, Class II. $2.60 per day plus $1.04 C.O.L.A. = $3.64 per day	0.56	,, ,,
Motor Cultivator Drivers. $1.12 per day plus $0.72 C.O.L.A. = $1.84 per day	0.28	,, ,,
Labourers, unclassified. $0.96 per day plus $0.68 C.O.L.A. = $1.64 per day	0.25	,, ,,

Table I provides a summary of the calculated costs per hour of certain operations with some of the tractors now in use in Malaya, based on the present price of tractors, fuel, lubricants and wages; it is similar, as regards methods of calculation, to that given on page 24 of the *Malayan Agricultural Journal* of January, 1948. It must, of course, be realised that these costs do not take into account the costs of supervision, which are often, of necessity, high in Malaya, nor such factors as the short period of time each year during which it may be possible to work tractors in Malaya owing to climatic conditions. When calculating the costs of work to be done on contract, the cost of transporting tractors and their implements, which may be considerable, should be included.

* C.O.L.A. = Cost of Living Allowance.

NOTES ON CURRENT INVESTIGATIONS, OCTOBER TO DECEMBER, 1949.

Compiled by the Acting Chief Research Officer and the Acting Senior Agricultural Officer, (Research).

Padi.

Analysis of results of the 1948-49 variety trials has been completed and data are being correlated with the previous season's results with a view to revision of programmes in 1950-51. Growth and condition of selection plots of the six varieties mentioned in the last notes published in this Journal have been satisfactory, and ear-row selection plots of Acheh Puteh and Serayap have been sown at Sungei Burong and Panchang Bedena in Selangor. Various fungal diseases have been investigated in the field. In Kelantan, attacks of *Penyakit Merah* were not of parasitic origin, and were demonstrated by the State Agricultural Officer to be quite spectacularly cured by direct application of bat guano to the roots of the affected plants. Chemical analysis of affected plants showed that although the plants were not deficient in mineral nutrients, the manurial treatment greatly enhanced the latter. Trials are in progress of phosphorus-containing systemic insecticides against padi stem-borers.

Cocoa.

Following selection of parent trees as recorded in the last notes, cuttings from twenty such trees have been established and have been planted out in a clonal selection trial at Serdang. Further cuttings are being rooted with a view to providing a "cutting-wood nursery" for the supply of more clonal cuttings. Controlled pollinations between selected trees are in progress, and already some twenty of the progenies are being raised. The field experiments on Agricultural Stations and on estates are yielding useful information for guidance in future work.

The most important problem at present being tacked is that of establishment, and the methods used up to the present have, in general, approximated closely to those in use in the West Indies which necessitate the planting of primary, secondary, and tertiary shades before the cocoa is transplanted. It already seems clear that in most conditions in Malaya cocoa is less intolerant of lack of shade than it is of root competition, and the thinning out of primary shade or its removal and substitution by palm fronds almost invariably leads to an increase in growth rate of the cocoa. It may be taken, therefore, that living primary shade is often more likely to do harm than good in Malaya except in conditions where it is necessary to prevent erosion. The importance of secondary shade cannot yet be determined but not only Trinitario but also Criollo trees, which are generally considered to be more delicate, may be seen growing satisfactorily in the open without any shade, and the fact that in the mature cocoa at Cheras

the *Gliricidia* is giving virtually no secondary shade at all should also be taken into consideration. It has often been pointed out that in the West Indies the tertiary shade of Immortelle trees is leafless during the dry season when shade is presumably most required, and recent work in Ceylon has shown that in the case of tea, high shade, which was considered essential for so many years, is really unnecessary. Further investigations are being started to test certain tree species as windbreaks rather than as shade.

The quality of the cocoa from the manufacturer's point of view is of importance when selecting trees, but up to the present no satisfactory technique is known for fermenting small quantities of cocoa beans so as to develop the same flavour as would result from normal fermentation of large masses. Fermentation as such has been successfully brought under laboratory control, but investigations are being continued into the correct conditions for attaining an acceptable flavour.

Oil Palms.

Breeding work on oil palms continues on palms selected for high yield and especially palms of the "dumpy" family. This family is a small group of palms at Serdang raised by self-pollination of a single individual. These palms are entirely normal in character and dimensions except that the rate of increase in height is smaller and the increase in girth of stem greater than is usual. Selection is continuing for character of fruit and oil-content.

Tea.

An experiment in various methods of packing tea seed for export was made in which fresh seed from Cameron Highlands was packed in boxes in various ways and stored for 6 weeks at Serdang, followed by a germination test. The best result was obtained by packing in moist coconut fibre, whether ventilated or not, although, even by this method, there was a reduction in viability of 40 per cent. The common procedure of packing the seed in charcoal was very much less suitable.

Sweet Potatoes.

A series of trials with ten varieties, judged to be the best from previous experience, has been made at four centres, Serdang, Penang, Malacca and Kelantan. From the results there is good evidence that the four highest yielding varieties are Hoey Tong, Serdang I, Ampat Bulan and Large White, and that the optimum maturation period is between 120 and 135 days. These high yielding varieties are to be compared for palatability.

Tapioca.

A similar trial has been made at Serdang with twelve varieties of tapioca of which four were shown to be outstandingly good. These varieties are to be tested at other Stations with different soils and climates.

Clover.

Following unsuccessful attempts to establish common red clover at Cameron Highlands, Ladino clover, a giant white clover of North America has been found to grow vigorously. It has a low habit of growth and has never yet flowered, but spreads easily and gives promise of providing a valuable and much needed cover crop for Highlands tea plantations. This clover has considerable potentialities as a fodder. A quantity was dried by use of tea machinery, for convenience, giving a type of meal of pleasant aroma, which, assessed by chemical analysis, is highly nutritious and superior in feeding value to imported Lucerne meal.

Soils.

Pot experiments were made with soil taken from a *sawah* (rice field) in the south of Selangor to investigate the effect of the addition of various trace elements on the growth of padi. None of the treatments has shown any benefit over the control, but the vanadium and molybdenum treatments have stunted the plants and decreased the yield considerably.

A systematic soil survey of the Trans-Perak padi irrigation scheme is in progress and since the last report about 300 samples of soil from an area of some 35 sq. miles have been analysed. In this particular area the soil is predominantly clay.

A collection of soil samples has been begun from padi *sawahs* in which consistently high and low yields have been experienced, for the purpose of a close comparison of their characteristics. The first batch of these was from North Malaya and they will be followed by similar samples from the other principal padi areas.

The examination of peat in various localities is in progress with a view to classification according to the original materials and course of formation. The present constitution and properties are being determined by analysis and laboratory experiment, and at the same time the relation of peat to crops is being studied.

Canning Research.

At the Canning Research Station, Johore Bahru, numerous successful trials have been made of canning local foodstuffs, such as might be suitable to provide materials for the pineapple canneries during the pineapple off-season.

RICE PRODUCTION, SEASON 1949-50.

The present season gives every indication of being a record one in the history of Malaya, and a preliminary forecast, based on estimates from State and Settlement Agricultural Officers, shows that rice production will probably exceed 400,000 tons, as compared with 307,180 tons in the 1948-49 season.

The principal reasons for this large crop are the excellent weather conditions that have so far prevailed, particularly in the important rice growing State of Kedah, and the exceptionally high yield, well above the average, that is expected.

Kedah, which has a third of Malaya's padi land, expects the high average yield of 409 gantangs per acre, the highest average yet recorded. This compares with 219 gantangs last season when over 41,000 acres of padi were destroyed by drought and the remaining padi suffered severely.

Perlis also estimates a high average yield of 338 gantangs as compared with 207 gantangs in the previous season. The other large increase in yield is expected in Penang and Province Wellesley with 292 gantangs as compared with 183 gantangs in 1948-49.

It is at present estimated that the overall average yield for the Federation will be 309 gantangs per acre as compared with 242 gantangs last season.

THE PINEAPPLE INDUSTRY OF THE HAWAIIAN ISLANDS.

Attention is drawn to an important Special Bulletin recently published by the Department of Agriculture which is a report on a visit by Mr. F. C. Cooke, Canning Officer of the Department, to the United States of America and to the Hawaiian Islands to study the Hawaiian pineapple industry.

The report, which is well illustrated, gives an extremely interesting and comprehensive picture of the Hawaiian industry, and gives also Mr. Cooke's recommendations for the development of the Malayan pineapple industry. It should be read and carefully studied by all interested in the canning industry. The report is on sale at $5, and can be obtained from the Department of Agriculture, Kuala Lumpur.

Departmental Notes.

Promotions.

The Right Honourable the Secretary of State for the Colonies has approved the promotion of Mr. C. W. S. Hartley, Agricultural Officer (Research), to be Senior Agricultural Officer (Research) with effect from 5th August, 1948.

The Right Honourable the Secretary of State for the Colonies has approved the promotion of Mr. H. J. Simpson, Agricultural Officer, to be Senior Agricultural Officer with effect from 10th November, 1948.

Appointments.

Mr. J. Chattaway has been appointed to be an Agricultural Officer, Malayan Agricultural Service, with effect from 21st October, 1949. Mr. Chattaway arrived in Malaya on the 13th November, 1949, and is stationed at the Federal Experiment Station, Serdang, Selangor.

Mr. D. W. M. Haynes has been appointed to be an Agricultural Officer, Malayan Agricultural Service, with effect from 18th November, 1949. Mr. Haynes arrived in Malaya on the 11th December, 1949, and is stationed at the Federal Experiment Station, Serdang, Selangor.

Leave.

Mr. R. G. H. Wilshaw, Chief Research Officer, returned from leave on 11th December, 1949. Mr. Wilshaw has been appointed the Deputed Officer to the Organization and Methods Adviser with effect from the 12th December, 1949.

His Highness Tengku Yaacob ibni al-marhum Sultan Abdul Hamid, C.M.G., Senior Agricultural Officer, returned from leave on 24th December, 1949, and resumed duty as State Agricultural Officer, Kedah and Perlis.

Mr. R. B. Jagoe, Senior Botanist, returned from leave on 22nd November, 1949, and resumed duty at Headquarters with effect from 23rd November, 1949.

Mr. A. Thompson, Senior Pathologist, returned from leave on 30th November, 1949, and resumed duty on the same day.

Transfers.

Mr. J. R. P. Soper, Senior Agricultural Officer, has been transferred to Tanganyika with effect from 21st November, 1949, on promotion to the post of Deputy Director of Agriculture, Tanganyika.

Mr. J. Cook, Agricultural Officer, Acting State Agricultural Officer, Kedah, has assumed duty as Agricultural Officer, Kedah, with effect from 27th December, 1949.

MARKET PRICES

October to December 1949.

Rubber.—The Singapore price of No. 1 R.S.S., f.o.b., in bales, increased by a little more than 6 cents per lb. during the last quarter of 1949.

In October the price remained fairly constant, opening at 44 cents and closing at 44⅛ cents per lb., the average price for the month being 43.98 cents. November showed an increase from 44½ to 46⅜ cents per lb., with an average price of 45.72 cents. The last two days of December brought the highest price of the year, 50⅛ cents, and made the average price for the month 48.44 cents per lb.

The average price of No. 1 R.S.S., f.o.b., in bales, for 1949 was 38.19 cents per lb.

The average prices paid for smallholders' rubber at three centres in the Federation of Malaya during the last quarter of 1949, are given in Table 1.

Table I.

Average Monthly Prices Paid by Local Dealers for Small-Holders' Rubber, October to December, 1949.

(Dollars per picul of 133⅓ lbs.)

Grades	Taiping, Perak.			Seremban, Negri Sembilan.			Batu Pahat, Johore.		
	Oct.	Nov.	Dec.	Oct	Nov.	Dec.	Oct	Nov.	Dec.
Smoked Sheet ..	50.50	54.50	61.50	53.45	55.80	59.50	47.00	53.40	58.20
Unsmoked Sheet ..	44.50	50.00	53.50	44.30	48.00	51.50	44.17	47.90	51.05
Scrap ..	20.00	21.50	20.00	21.00	25.00	26.00	17.50	18.75	21.65

Transport from Batu Pahat to Singapore by lorry, excluding duty, 80 cents per picul.

Tea.—The average price paid in Colombo for Malayan tea, as quoted in the Colombo Brokers' Association weekly report dated 31st December, 1949, was Rs.2.12 per lb. The average prices of Ceylon teas were as follows, in rupees per lb.: High Grown Teas Rs. 2.61, Medium Grown Teas Rs.2.19, Low Grown Teas Rs.2.15.

Ceylon teas are subject to an export duty but non-Ceylon teas sold at auctions ex-bond in Colombo for re-export are not subject to this duty.

The retail price for Malayan tea (Boh) has remained at $2 per lb.

Palm Oil.—The price paid to producers by the United Kingdom Ministry of Food, who continue to purchase the majority of Malayan estate production, remained at £82 per ton f.o.b. Malayan ports. The 5 per cent. *ad valorem* Malayan export duty is for buyers' account.

Derris.—The Singapore Chamber of Commerce weekly reports have shown no change in the Singapore price of this commodity which, for three months, has remained at a steady $85 per picul.

Tobacco.—The average prices paid per picul for cured leaf in Kelantan during the last quarter of 1949 were as follows:—1st quality $433, 2nd quality $300, and 3rd quality $217.

Rice.—The rice ration in the Federation of Malaya remained at 3½ katis per person per week. The controlled price of rice has been reduced to $26 per picul.

Table II.

Singapore Prices of Various Agricultural Products.

(per picul)

Product	December, 1949			November, 1949	Oct., 1949	Average Price 1948
	Highest	Lowest	Average	Average	Average	
	$	$	$	$	$	$
Copra:						
Sundried No. 1 ..	35.75	34.50	35.06	34.75	30.10	38.77
Coconut Oil ..	60.00‡	58.00‡	59.25‡	58.00‡	53.60‡	68.74
Coffee:						
Padang Bali No. 1	*	*	*	*	*	115.35
Palembang No. 1	*	*	*	*	*	72.19
Sourabaya No. 1	*	*	*	*	*	82.32
Pepper:						
Muntok White ..	910.00	860.00	887.50	907.50	821.80	181.63
Sarawak ..	*	*	*	*	*	180.63
Gambier:						
Rounds No. 1 ..	260.00	260.00	260.00	26.00	*	127.22†
Cube ..	47.00	48.00	47.25	48.75	50.60	*
Sago Flour:						
Lingga ..	13.75	13.75	13.75	13.00	12.50	18.55
Tapioca Flour:						
Malayan No. 1 ..	15.00	15.00	15.00	16.33	17.60	30.48

* Not quoted. † Average January-November.
‡ F.O.B. price.

FEDERATION OF MALAYA

PRODUCTION OF PALM OIL AND KERNELS.

(In long tons as declared by Estates)

Month	Palm Oil		Palm Kernels	
	1948	1949	1948	1949
January ..	3,821.9	3,793.0	664.1	799.9
February ..	3,659.8	4,007.0	677.9	821.4
March ..	3,567.6	4,055.6	633.0	860.1
April ..	3,598.6	3,999.3	699.4	808.3
May ..	3,076.5	4,120.9	597.4	809.2
June ..	2,420.1	4,321.5	431.0	791.2
July ..	3,245.5	4,461.3	564.9	931.0
August ..	3,617.8	4,398.2	690.2	906.0
September ..	4,283.4	4,234.9	827.2	858,9
October ..	4,376.6	4,125.5	899.4	875.3
November ..	4,827.2	4,504.3	913.6	994.1
December ..	4,762.4	4,539.2	873.0	1,004.0
Total ..	45,257.4	50,560.7	8,471.1	10,459.4

In December 46 estates (planted area 85,518 acres) were in production out of a total of 53 oil palm estates (planted area 88,210 acres).

MALAYAN AGRICULTURAL EXPORTS, JULY-SEPTEMBER, 1949.

Product	Net Exports in Tons.			
	Year 1947	Year 1948	July-Sept. 1948	July-Sept. 1949
Arecanuts	12,507	6,043	2,483	841*
Coconuts fresh†‡ ..	62,873†	44,887†	6,922†	8,145†
Coconut oil‡	41,112	45,245	10,176	20,927
Copra‡	45,439*	28,625*	3,725*	6,965*
Copra cake	5,260*	12,176*	5,061*	6,376*
Gambier, all kinds ..	1,156	286	145	73
Palm kernels	5,245	6,462	711	1,916
Palm Oil	43,325	46,821	10,479	13,230
Pineapples, canned ..	2,611	4,073	2,135	2,509
Rubber¶	645,229¶	696,978¶	178,969¶	171,778¶
Sago,—flour	5,958	16,946*	8,612*	1,636*
„ —pearl	2,404	19,084	6,452	464
„ —raw	6,415*	6,667*	1,878*	21*
Tapioca,—flake	52	304	118	160
„ —flour	6,490	1,999*	655*	172
„ —pearl	7,205	14,263	3,913	2,609
Derris	243	80	33	24
‡Copra equivalent ..	22,625	45,795	12,949	27,204

¶ production (Federation of Malaya). † hundreds in number. * net imports.

FEDERATION OF MALAYA.

PADI SEASON 1949—1950.

Acreages of WET Padi Planted monthly during 1949 and Percentages of Total Planted Area.

State/Settlement	Jan.—Sept. (2)		October (3)		November (4)		December (5)		Total (6)		Total Area Planted and to be Planted	Per cent
	Planted Acres	Per cent of (7)	Planted Acres	Per cent of (7)	Planted Acres	Per cent of (7)	Planted Acres	Per cent of (7)	Planted Acres	Per cent of (7)	(Acres) (7)	(8)
Perlis ..	43,330	91.5	3,930	8.3	60	0.2	—	—	47,320	100.0	47,320	5.6
Kedah ..	274,920	97.3	6,380	2.3	1,150	0.4	20	—	282,470	100.0	282,470	33.0
Kelantan ..	37,020	28.1	66,530	50.5	25,100	19.0	1,150	0.9	129,800	98.5	131,760	15.5
Trengganu ..	18,030	37.7	14,930	31.2	14,330	30.0	540	1.1	47,830	100.0	47,830	5.6
Penang & P. Wellesley ..	29,380	74.0	9,550	24.1	770	1.9	—	—	39,700	100.0	39,700	4.7
Perak ..	87,970	70.6	27,260	21.9	7,340	5.9	80	0.1	122,650	98.5	124,560	14.6
Selangor ..	5,230	11.3	670	1.4	11,160	24.1	5,960	12.9	23,020	49.7	46,350	5.4
Pahang ..	41,240	93.5	1,920	4.4	820	1.9	110	0.2	44,090	100.0	44,090	5.2
N. Sembilan ..	33,800	99.3	220	0.6	30	0.1	—	—	34,050	100.0	34,050	4.0
Malacca ..	31,210	96.6	900	2.8	210	0.6	—	—	32,320	100.0	32,320	3.8
Johore ..	17,120	77.6	950	4.3	1,010	4.6	290	1.3	19,370	87.8	22,060	2.6
Total ..	619,250	72.6	133,240	15.6	61,980	7.3	8,150	1.0	822,620	96.5	852,510	100.0

Area to nearest 10 acres.

FEDERATION OF MALAYA.

PADI SEASON 1949—1950.

Total Acreages of WET and DRY Padi Planted and to be Planted.

State/Settlement	Wet Padi		Dry Padi Total Planted and to be Planted	Total Wet and Dry Padi Area Planted and to be Planted
	Planted by 31st December, 1949 Acres	Total Planted and to be Planted Acres	Acres	Acres
Perlis ..	47,320	47,320	210	47,530
Kedah ..	282,470	282,470	6,080	288,550
Kelantan ..	129,800	131,760	30,110	161,870
Trengganu ..	47,830	47,830	11,180	59,010
Penang & P. Wellesley ..	39,700	39,700	900	40,600
Perak ..	122,650	124,560	5,850	130,410
Selangor ..	23,020	46,350	350	46,700
Pahang ..	44,090	44,090	1,410	45,500
Negri Sembilan ..	34,050	34,050	10	34,060
Malacca ..	32,320	32,320	40	32,360
Johore ..	19,370	22,060	1,790	23,850
Total ..	822,620	852,510	57,930	910,440

Area to nearest 10 acres.

FEDERATION OF MALAYA RUBBER PRODUCTION.

(In long tons, dry weight)

Month	Estates		Small-holdings (Estimated)		Total	
	1948	1949	1948	1949	1948	1949
January ..	34,668	36,397	27,321	24,052	61,989	60,449
February ..	28,529	27,593	22,121	17,450	50,650	45,043
March ..	31,888	33,616	26,549	20,309	58,437	53,925
				14,113†		14,113†
April ..	32,724	28,142	33,684	16,744	66,408	44,886
May ..	33,294	33,570	16,313	18,499	49,607	52,069
June ..	33,246	32,921	27,348	18,683	60,594	51,604
				2,705†		2,705†
July ..	35,193	35,751	22,972	20,137	58,165	55,888
August ..	33,727	36,658	22,875	20,504	56,602	57,162
September ..	33,292	33,828	30,910	24,900*	64,202	58,728*
October ..	34,020	30,788	16,347	20,096	50,367	50,884
November ..	34,149	35,169	27,822	23,825	61,971	58,994
December ..	38,177	35,576	19,809	23,977	57,986	59,553
				4,254†		4,254†
Total ..	402,907	400,009	294,071	270,248	696,978	670,257
Total 1947 ..	359,865		285,364		645,229	

Small-holding production is estimated from purchases reported by dealers; prior to 1949 it was estimated from the formula: Production + imports + opening stocks = exports + consumption + closing stocks.

† Quarterly adjustment.

* Includes quarterly adjustment (deduction of 822 tons).

FEDERATION OF MALAYA

PRODUCTION OF COPRA, COCONUT OIL AND COPRA CAKE.

(in tons)

Month	Copra Production						Coconut Oil Production		Copra Cake (Poonac) Manufactured	
	Estates		Small-holdings (estimated)		Total		Oil Mills		Oil Mills	
	1948	1949	1948	1949	1948	1949	1948	1949	1948	1949
January ..	—	2,476	—	7,406	—	9,882	3,302	4,727	2,512	3,245
February ..	—	2,605	—	5,544	—	8,149	3,224	4,429	2,432	3,027
March ..	—	2,644	—	4,981	—	7,625	3,910	4,638	2,913	3,211
April ..	—	2,755	—	6,203	—	8,958	4,054	4,832	3,223	3,325
May ..	—	3,039	—	5,884	—	8,923	3,124	4,995	2,446	3,437
June ..	—	3,500	—	6,723	—	10,223	3,729	5,607	2,955	3,756
July ..	2,971	3,838	2,619	6,915	5,590	10,753	3,625	5,710	2,901	3,870
August ..	3,227	3,867	8,731	8,676	11,958	12,543	4,556	5,671	3,484	3,858
September ..	3,326	3,651	7,077	9,256	10,403	12,907	5,266	6,282	3,730	4,190
October ..	3,371	2,778	10,037	7,745	13,408	10,523	5,535	5,440	3,933	3,711
November ..	2,992	3,035	8,377	9,332	11,369	12,367	5,096	5,736	3,669	3,871
December ..	3,124	2,769	8,767	7,315	11,891	10,084	5,743	5,631	3,772	3,799
Total ..	(19,011)	36,957	(45,608)	85,980	(64,619)	122,937	51,164	63,698	37,970	43,300

Notes:—1. The above statistics are compiled and published by the Registrar of Statistics, Federation of Malaya.

2. Estate copra production and coconut oil production are as declared by estates and oil mills respectively.

3. Statistics of small-holding coconut oil production are not available.

4. Small-holding copra production for commercial purposes is estimated from the formula: imports + estate stocks (opening) + estate production + small-holding production = exports + local oil mill consumption + estate stocks (closing).

5. Statistics of copra production prior to July, 1948, are not available.

METEOROLOGICAL SUMMARY, MALAYA, SEPTEMBER, 1949.

Locality	Air Temperature degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes									Number of days							
	A. Max.	B. Min.	Means of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot °F	At 4 feet °F	Total	Most in a day Amt.		Precipitation .01 in or more	Precipitation .04 in or more	Thunderstorm	Fog morning obs.	Gale force 8 or more	Total	Daily Mean	Per cent.
										ins.	m.m.	ins.								
Ipoh, Perak ..	91.0	72.4	81.7	94	70	85	75			15.60	396.2	3.05	17	17	3		1	181.60	6.05	
Port Swettenham, Selangor	88.5	72.3	80.4	92	70	83	75	84.3	84.9	8.79	223.3	1.76	23	16				152.50	5.08	
K. Lumpur, Selangor ..	89.2	72.5	80.9	94	70	84	75			7.19	182.6	1.04	23	17	5	3				
Sitiawan, Perak ..	88.3	72.6	80.5	91	69	85	75	84.6		9.64	244.9	2.65	18	14	4			186.55	6.22	
Kuala Lipis, Pahang ..	88.2	71.3	79.7	91	69	86	74	83.9	84.0	10.83	275.1	2.05	22	21	1	20	3	165.50	5.52	
Kuantan, Pahang ..	89.3	71.4	80.3	93	68	85	74			8.77	222.8	2.50	19	17	2	5		147.60	4.92	
Temerloh, Pahang ..		72.6			69		75			5.61	142.5	1.33	14	11		5	1	173.85	5.79	
Bayan Lepas, Penang ..	86.5	74.3	80.4	89	71	81	76			13.66	347.0	2.58	22	19	5			174.85	5.83	
Malacca ..	85.0	73.3	79.1	87	71	81	75			7.18	182.4	3.17	17	12			2	167.35	5.40	
Mersing, Johore ..	86.9	71.7	79.3	90	69	84	74			5.77	146.6	1.37	10	10	1		1	176.60	5.89	
Alor Star, Kedah ..	87.4	73.6	80.5	91	71	84	76			12.11	307.6	2.17	20	20	2			190.65	6.35	
Kota Bharu, Kelantan ..	88.3	73.5	80.9	91	71	85	76	86.7		6.65	168.9	1.51	14	10	3			200.90	6.70	
K. Trengganu, Trengganu		72.5			71		74			6.15	156.2	1.97	15	13	3		1	206.80	6.89	
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft. ..	74.0	62.1	68.1	79	60	69	65	72.4		8.10	205.7	1.11	22	21	5	10	1	149.15	4.97	
Cameron Highlands, Tanah Rata, Pahang 4750 ft.	73.1	55.6	64.3	76	49	68	60	68.7	70.0	11.92	307.4	1.41	21	20	2			126.85	4.23	

Compiled from Returns supplied by the Malayan Meteorological Service.

METEOROLOGICAL SUMMARY, MALAYA, OCTOBER, 1949.

Locality	Air Temperature degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes									Number of days							
	A. Max.	B. Min.	Means of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot °F	At 4 feet °F	Total		Most in a day Amt.	Precipitation .01 in or more	Precipitation .04 in or more	Thunderstorm	Fog morning obs.	Gale force 8 or more	Total	Daily Mean	Per cent.
										ins.	m.m.	ins.								
Ipoh, Perak ..	89.2	72.3	80.7	93	69	81	75			11.43	290.3	1.17	22	20	7	1		141.45	4.56	
Port Swettenham, Selangor	87.5	72.7	80.1	93	71	83	74	84.3	84.9	10.56	268.2	2.01	21	18		1		147.80	4.77	
K. Lumpur, Selangor ..	88.2	72.7	80.5	92	70	82	75			12.83	325.9	2.91	20	19	5	3				
Sitiawan, Perak ..	87.7	72.6	80.1	90	71	84	74			8.28	210.3	1.35	18	16	2	1		142.75	4.60	
Kuala Lipis, Pahang ..	87.6	71.9	79.7	91	70	85	74	83.5	84.1	6.57	166.9	1.56	23	19	4	22		135.60	4.37	
Kuantan, Pahang ..	89.1	71.9	80.5	94	70	83	75			21.31	541.3	6.47	27	25	5	4	1	128.45	4.14	
Temerloh, Pahang ..		73.1			72		75			10.13	257.3	2.51	21	16		4		139.30	4.49	
Bayan Lepas, Penang ..	84.9	74.2	79.5	89	72	78	77			17.21	437.1	4.89	29	26	5			114.00	3.68	
Malacca ..	84.6	73.4	79.0	87	71	81	78			11.45	290.8	2.41	22	19	1		11	167.35	5.40	
Mersing, Johore ..	87.3	72.1	78.7	90	71	82	75			8.86	225.0	1.16	16	5	2			143.80	4.64	
Alor Star, Kedah ..	85.0	73.3	79.1	91	71	78	75			18.38	966.9	3.35	26	25				109.15	3.52	
Kota Bharu, Kelantan ..	86.0	73.8	79.9	90	72	80	76	83.9		8.49	215.6	2.28	19	16	2	1		113.20	3.65	
K. Trengganu, Trengganu		72.9			71		75			8.91	226.3	1.85	19	18	5		1	130.65	4.21	
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft. ..	73.5	61.9	67.7	76	59	70	63	71.6		3.73	94.7	0.52	20	18	2	8	1	120.00	3.87	
Cameron Highlands, Tanah Rata, Pahang 4750 ft.	71.6	57.5	56.7	75	53	68	61	68.0	69.5	13.61	345.7	1.84	22	20	1			86.30	2.78	

Compiled from Returns supplied by the Malayan Meteorological Service.

METEOROLOGICAL SUMMARY, MALAYA, NOVEMBER, 1949.

Locality	Air Temperature degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes									Number of days							
	A. Max.	B. Min.	Means of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot °F	At 4 feet °F	Total	Most in a day Amt.		Precipitation .01 in or more	Precipitation .04 in or more	Thunderstorm	Fog morning obs.	Gale force 8 or more	Total	Daily Mean	Per cent.
										ins.	m.m.	ins.								
Ipoh, Perak ..	89.1	71.9	80.5	93	68	82	75			9.78	248.4	2.04	24	20	4		1	155.10	5.17	
Port Swettenham, Selangor	87.5	72.1	79.8	92	70	83	74	84.3	85.0	7.01	178.1	1.26	22	20	3	1		146.20	4.87	41
K. Lumpur, Selangor ..	87.7	72.5	80.1	91	70	82	74			11.37	288.8	2.78	27	24	6		7			
Sitiawan, Perak ..	87.6	72.4	80.0	91	71	83	75	84.0		8.37	212.6	1.82	23	20	5	3		153.70	5.12	
Kuala Lipis, Pahang ..	85.8	71.0	78.4	90	69	75	73	82.1	82.8	22.47	570.7	3.10	28	26	3	22		118.00	3.93	
Kuantan, Pahang ..	87.1	70.2	78.7	92	66	77	73			18.56	471.4	4.91	24	22	4	11		125.60	4.19	
Temerloh, Pahang ..		72.9			71		75			11.06	280.9	2.47	22	18		6		128.25	4.27	
Bayan Lepas, Penang .	85.9	73.8	79.9	89	72	82	76			6.48	164.6	1.40	24	18	4			160.05	5.33	
Malacca ..	84.5	73.2	78.9	89	71	79	75			3.15	80.0	0.67	15	14	17	3		152.20	5.07	42
Mersing, Johore ..	84.4	72.3	78.3	91	71	74	75			14.97	380.2	3.36	22	19	2		1	139.50	4.65	
Alor Star, Kedah ..	86.2	72.6	79.4	90	70	82	68			11.74	298.2	1.95	22	20	3			150.05	5.00	
Kota Bharu, Kelantan ..	85.0	73.5	79.3	89	71	76	76	82.1		32.65	829.3	5.10	19	18				146.35	4.88	
K. Trengganu, Trengganu		72.4			70		75			30.45	773.4	5.27	24	23	3	1	3	141.00	4.70	
HILL STATIONS																				
Fraser's Hill, Pahang 4268 ft. ..	71.7	61.7	66.7	76	59	63	63	70.5		13.96	354.6	1.95	29	27	1	14		97.20	3.24	
Cameron Highlands, Tanah Rata, Pahang 4750 ft.	71.4	57.1	56.4	75	52	65	60	67.1	68.1	10.60	269.2	1.31	19	11		6		87.85	3.26	

Compiled from Returns supplied by the Malayan Meteorological Service.